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Enhancing Interoperability Among Enlisted Medical Personnel

A Case Study of Military Surgical Technologists

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Prepared for the Office of the Secretary of Defense
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RAND
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A JOINT ENDEAVOR OF RAND HEALTH AND THE RAND NATIONAL DEFENSE RESEARCH INSTITUTE

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Preface

As medical staff are becoming more integrated in forward-deployed medical settings, the need for common training and a framework that allows service medical personnel to work together effectively and to know each other's capabilities is becoming increasingly evident. Both the 2005 Base Realignment and Closure (BRAC) Commission and the 2006 Quadrennial Defense Review (QDR) call for the transformation of medical education and training to foster interchangeability and interoperability among medical personnel and units across the services. The BRAC report recommended relocating basic and specialty enlisted medical training to Fort Sam Houston, Texas, to take advantage of economies of scale and the opportunity for joint training. To fulfill the BRAC recommendation, a joint medical education and training campus (METC) is being established at Fort Sam Houston, Texas. The QDR emphasized the need to prepare health care leaders to succeed in joint, performance-based environments.

RAND's National Defense Research Institute (NDRI) has been asked to provide technical and research assistance to facilitate implementation of joint medical training and education in three major areas:

- determining joint versus service-specific standard of practice for medical specialties
- developing a framework for METC's lifelong learning professional development and performance-based leader development training programs

- establishing the knowledge base and analytic capability to ensure effective and efficient delivery of training at the METC.

The project began August 2006 and is largely focused on medium-term and long-term issues. In July 2007, RAND was asked to focus on the surgical technologist/operating room technician specialty and to define a common capability set for it. This monograph presents the methodology RAND developed to define and evaluate a common standard of practice for enlisted medical specialties and the results of applying that methodology to the surgical technologist specialty. As part of the analysis, we consider various options for obtaining trained surgical technologists, including both "make" and "buy" options. We also discuss the value of program accreditation and individual professional certification. This monograph should be of interest to personnel and military planners involved in medical workforce education and training.

This research was sponsored by the Military Health System Office of Transformation (MHS-OT). The study was conducted jointly by RAND Health's Center for Military Health Policy Research and the Forces and Resources Policy Center of the National Defense Research Institute. NDRI is a federally funded research and development center sponsored by the Office of the Secretary of Defense, the Joint Staff, the Unified Combatant Commands, the Department of the Navy, the Marine Corps, the defense agencies, and the defense Intelligence Community. The principal investigators are Sheila Nataraj Kirby and Harry J. Thie. Comments are welcome and may be sent to harry_thie@rand.org or sheila_kirby@rand.org.

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Background and Purpose

Following the recommendations of the 2005 BRAC Commission, a joint medical education and training campus (METC) is being established at Fort Sam Houston, Texas, to provide training for enlisted medical specialties in the Air Force, Army, and Navy. Currently, the idea is to collocate the three service schools and to consolidate medical training for all services to the extent feasible. The shorter-term objective is efficiency—to reduce the overall costs of training; the longer-term objective is to increase the interoperability of the services by training service specialists to a common standard.

RAND is providing technical assistance to the Executive Integrated Process Team (EIPT) that is overseeing the implementation of the METC in a number of areas, including determining joint rather than service-specific standards of practice (SOPs) for medical specialties. An SOP encompasses a set of standardized tasks that individuals who are proficient at a given level must be able to perform. In addition, the SOP often delineates the knowledge, skills, and abilities such individuals need to be competent in the job.

It is useful to distinguish the work that RAND is doing from the work being done by the Health Care Interservice Training Office (HC ITO). This office uses the Interservice Training Review Organization (ITRO) process to examine commonalities in training curricula for enlisted medical specialties, whose training will come under the purview of the METC. The RAND tasking is broader than that currently being undertaken by the HC ITO—we have been asked to examine

more comprehensively what constitutes an occupation, to examine commonality of work across the services rather than commonality of training as currently provided, to address issues related to implementing a common SOP, and to analyze the implications of common work and common training for increased interoperability among individuals, units, and forces.

In July 2007, RAND was asked to focus on the surgical technologist/operating room technician specialty and to define an SOP for this specialty, which includes the Army's Operating Room Specialist (68D), the Navy's Surgical Technologist (HM 8483), and the Air Force's Surgical Services Apprentice (4N131) and Surgical Services Journeyman (4N151). We grouped these three specialties under the common term "surgical technologist."

This monograph documents the results of the study and makes three important contributions. First, it outlines a methodology for defining a common standard of practice that can be applied to any specialty and illustrates the use of that methodology by applying it to the surgical technologist specialty. Second, it offers a method for identifying and systematically evaluating the effect of different methods for training or obtaining qualified medical personnel on Department of Defense (DoD) and service objectives. Third, it examines the link between common work (SOP), common training, and interoperability. There is a commonly held misconception that common work and common training will, by themselves, ensure greater interoperability. Although common training enhances person-level substitutability, translating this micro-level substitutability into increases in overall system-level capability requires fundamental changes in areas related to service doctrine, organization, training, materiel, leadership, personnel, and facilities (DOTMLPF).

A Methodology for Defining and Implementing a Standard of Practice for a Given Specialty

Rather than simply focusing on the surgical technologist specialty, we began the analysis by developing a common methodology that could

be applied more broadly across different specialties. This methodology consists of the following three major analytical tasks:

- Define a common SOP for the specialty based on job descriptions in both the military and civilian sectors. The SOP needs to be pegged to a given proficiency level.
- Validate the SOP through subject matter experts (SMEs) from both the military and civilian sectors. This can be done informally or formally through well-tested methods (for example, the Delphi process) that are used to achieve consensus.
- Identify a set of training options for "making" or "buying" individuals with the given level of proficiency in the SOP. Evaluate the options against the criteria of cost and productivity and the effect on service culture, recruitment, and retention.

We then applied this methodology to the surgical technologist specialty across the three services.

Who Is a Surgical Technologist?

The surgical technologist is an integral member of the team of medical practitioners providing surgical care to patients in a variety of settings. Some surgical technologists work in supply; for example, managing central supply departments in hospitals or working with firms that provide sterile supply services or operating equipment. Technologists can also specialize in a particular area of surgery, such as neurosurgery or open-heart surgery, or, with additional training, can advance to the higher level of surgical first assistant.

Surgical technologists working in the services have jobs that are very similar in scope to those of civilian surgical technologists, but they also need a separate set of military-related skills that do not fall under the SOP of a civilian surgical technologist, including working in forward-deployed settings, working with severe trauma cases and other war-related injuries, or operating in chemical, biological, radiological, nuclear, and explosive (CBRNE) environments.

In the civilian sector, most surgical technologists work in hospitals. Some work in outpatient surgicenters and clinics. In the military, surgical technologists are largely employed in military treatment facilities, where they may work in the surgical suite or in clinical settings; in the Navy, some are aboard Navy ships. During war, they may be with medical units, working in deployed settings.

How the Services Currently Train Surgical Technologists

Currently, each service trains its surgical technicians differently. The Air Force Surgical Services Apprentice (4N131) course consists of 368 hours of Phase I didactic training at Sheppard Air Force Base and 240 hours of Phase II clinical training at one of six sites. The projected FY 2007 throughput was 116 students. The Army's Operating Room Specialist (68D) course consists of 408 hours of Phase I didactic training at Army Medical Department Centers and Schools (AMEDD C&S), followed by 400 hours of Phase II clinical training at one of 14 sites. The projected FY 2007 throughput was 300 students. The Navy's Surgical Technologist (HM 8483) course, which is accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP), consists of 456 hours of Phase I didactic training at the Naval School of Health Sciences (NSHS), San Diego and Portsmouth, followed by 600 hours of Phase II clinical training at one of five sites. The projected FY 2007 throughput was 312 students. Before coming to the surgical technology program, students must attend the HM (Corpsman) "A" school, a 14-week course mandatory for all Navy medical personnel. Additionally, all HM 8483 students must attend the six-week Field Medical Service School (FMSS).

The military has about 4,800 surgical technologists, more than half of whom are in the Army. Over 40 percent of all military surgical technologists are military reservists. It is interesting to note that data on the civilian employment of military surgical technologist reservists show that only 31 percent of Army, 39 percent of Air Force, and 16 percent of Navy reservists are employed as surgical technologists in

civilian life. Fifteen percent of Army reservists, 25 percent of Air Force, and 26 percent of Navy work in other health-related occupations.

Defining and Validating a Standard of Practice for the Surgical Technologist Specialty

Before defining the SOP, we selected the proficiency level for the specialty to which the SOP would be pegged. We chose a level of proficiency that could be expected of someone who graduates from an accredited program with eligibility for professional certification, i.e., someone is eligible to become a certified surgical technologist (CST) by passing the professional examination. This proficiency level implies that the graduate can function relatively independently and as a productive member of the surgical team.

We developed the SOP for the surgical technologist specialty from job analyses and descriptions from a variety of civilian and military sources. We compiled a list of tasks performed by personnel in each service using service source documents as well as tasks performed by civilian surgical technologists. We grouped these tasks into broad activity categories. We went through the list of activities checking to ensure that the full list of activities created a robust description of the career field that focused on the medical standard of practice and was not redundant. We removed several activities from the full list that contained similar or overlapping work. We also deleted several activities that we deemed to fall outside the SOP for a surgical technologist (for example, more advanced work that a surgical first assistant might perform) or that were not medical work (such as training, career development, peer mentoring—activities often required of more senior personnel).

We validated the SOP with subject matter experts from each service and through informal feedback from civilian professional associations and accreditation bodies. The final SOP consists of 30 broad

activities grouped into three categories: patient activities, mixed patient and nonpatient activities, and nonpatient activities.[1]

Identifying and Assessing Training Options

In identifying training options, we first examined the HC ITO reports. In its ITRO reviews, the HC ITO considered two options for consolidating training (a "currently achievable option" and a "following best practices option") that closely resembled the current Air Force and Navy training paradigms. We selected four options for training or obtaining qualified surgical technologists. These options are shown in Table S.1.

Option 1, the "make" option, consists of comparing what the services are currently doing with the following best practices option. It was clear from the ITRO reviews that even if the services were to choose the more constrained training option, the Army and Navy would continue to train to their current levels. As a result, we decided to use the service-specific current training regimen as the baseline (which we refer to as the "current practice" option) and compare it with the following best practices option. For the Navy, which already trains to the following best practices option but also has a prerequisite HM 0000 course, we considered two options: with and without the HM 0000 course.

Options 2 and 3 are "buy" options—one involving lateral entry of trained surgical technologists and the other involving outsourcing training to civilian institutions. We also included a fourth option—civilianization of the military billets. Although further conversions of military medical billets have been halted by the National Defense Authorization Act of 2008, this option may be worth considering in the future.

Given the options, the next task was to assess their effect across a number of areas identified as important to the DoD and the services: effects on interoperability, costs, service culture, recruitment, and retention.

[1] Table 4.1 in the main body of the report describes the complete RAND SOP.

Table S.1
Options for Obtaining Qualified Surgical Technologists

Option	Service Basic Training (weeks)	Consolidated and Service-Unique Training (Phase I) (hours)	Other Training
In-House Training			
Current practice			
Air Force	8	368	240 hours Phase II + OJT
Army	8	408	400 hours Phase II
Navy	8	456	600 hours Phase II
Navy with HM 0000 course	8	456	600 hours Phase II; additional 14 weeks of HM 0000 course before surgical technologist training
Following best practices	8	456	600 hours Phase II
Lateral entry of trained surgical technologists	8		2 weeks orientation
Civilian-provided training	8		~50 weeks civilian training + 2 weeks orientation
Conversion to civilian positions	N/A	N/A	N/A

Effect on Individual Interoperability

To foster interoperability, any training option that trains individuals to a common standard will necessarily rank higher on the interoperability criterion than current service-unique training. Although it is difficult to argue that one option ranks higher than another on the interoperability criterion, one could argue that longer consolidated programs are likely to increase standardization in both quality and capability sets than are programs with a large component of service on-the-job training (OJT). This may also be a concern with civilian-provided training (if it is done at

multiple sites) or with lateral entry but probably less of a concern if the programs are accredited and result in the CST credential.

Effect on Cost and Productivity

In our analysis, we focused largely on Option 1 and its variants because training in-house appears to be the most viable in the short-term. However, we did some simple calculations for Options 2 and 3 as well.

With respect to in-house training, we compared the increase in proficiency estimated to result from a longer training period with the increase in costs attendant on lengthening the training. We surveyed supervisors in the services and asked them to assess the proficiency of graduates against a fully mission-effective surgical technologist, defined to be 100 percent effective. We then developed a measure of the overall effectiveness of the surgical technologist workforce by combining the number of surgical technologists at each year of service and their levels of effectiveness. For example, if the services were all to adopt the following best practices option, we estimate that the total number of effective man-years in the surgical technologist workforce would increase by 3.7 percent in the Army, 6 percent in the Air Force, and 1.9 percent in the Navy and could lead to similar decreases in manpower authorizations. This also means that, holding the retention profile constant, the number of students to be trained to support that workforce could also eventually decline, as the workforce becomes staffed by more productive members.

The medical sector has certain characteristics that may hinder translating these gains in workforce effectiveness into savings in manpower and student throughput. For example, most members work in teams with fixed proportional representation (for example, one surgeon, one nurse, and one surgical technologist), so opportunities to reduce manpower may be limited, without major changes in the way teams are authorized and employed. However, if graduates are more fully trained at the outset, this would imply less need for a supervisor to be overseeing the graduate's work in initial assignments and could lead to a reduction in required manpower at the larger facilities.

On the other side, we need to balance the increased costs associated with a considerably longer training period under the following

best practices option. The costs of training increase for both the Army and Air Force as they move to the longer training option: by about $220,000 per year or 14 percent over the current practice option for the Army and by about $330,000 per year or 33 percent for the Air Force. If the Navy decided not to train its surgical technologists in the HM 0000 course, it could save about $1 million or 33 percent in total training costs.

As for the other options, hiring trained surgical technologists may prove an attractive viable "buy" option because civilian surgical technologists appear to earn less, on average, than military surgical technologists. It would be important to do a pilot test of recruiting to test the feasibility of this option.

The other option we considered—civilian-provided training of enlisted members—is expensive because of the length of the civilian training (almost double the length in the following best practices option). Too much career time is devoted to training; there are likely to be higher direct costs and high administrative costs. However, it might be possible to team with the civilian institution to offer shorter, more tailored courses targeted at military students.

Effect on Service Culture

In-house training, given that it reflects what the services are doing, is unlikely to have large differential effects on service culture compared with the status quo. However, one could argue that the reality of consolidated training means more limited opportunities for exposure to one's own service culture. The other two options—lateral entry of trained civilians and outsourcing training—will reduce the opportunities for service acculturation and thus rank lower than in-house training on this criterion.

Effect on Propensity to Enlist and to Remain in the Service

Compared with the other options, METC-provided training is likely be neutral in its effects on the propensity to enlist. If all trainees are offered the opportunity to obtain the CST credential (as under the following best practices option), this may increase the propensity to enlist; it may also lead to higher retention if being credentialed results

in faster advancement. This may also cause some individuals to leave if they perceive better opportunities in the civilian sector (although average civilian wages are currently somewhat lower than overall military compensation).

Lateral entry of trained civilians may increase enlistment if older trained individuals are attracted by the benefits package or job security of the military. In addition, it could increase retention if these individuals came in at higher pay grades or with increased promotion opportunities.

Outsourcing training to civilian institutions may increase the propensity to enlist as other students are exposed to military students and become aware of potentially immediate job opportunities within the military. However, greater exposure to the civilian labor market might cause lower retention, especially if service members have not had an opportunity to be fully acculturated to their service culture and values.

Two other considerations we took into account as we crafted and assessed options were accreditation and professional certification.

Program Accreditation and Professional Certification

Our interviews with the professional associations and the certification and accreditation organizations highlighted the importance of accreditation as an external validation of the program, ensuring both the quality of the program and the quality of the practitioners graduating from that program.

Generally, professional certification is regarded as providing evidence that the certified individual has met the national standard for the knowledge that underlies practice in that field. Despite this, only 31 percent of surgical technologists are certified. The evidence from an informal survey of job openings across the country suggests that lack of certification is not a bar to employment. Individuals can and do work as surgical technologists without being certified. However, this may change in the future as demand for surgical technologists increases and the nature of the work changes to include some tasks currently undertaken by nurses.

Recommendation

Overall, we find that the following best practices option has a number of advantages. First, it offers a higher level of interoperability because individuals are trained to a higher standard. Second, it offers both an accredited program and the opportunity to obtain professional certification—both avowed goals of the METC. Third, although training costs are higher, there is likely to be a gain in overall workforce productivity in the steady state with a small potential for long-term savings in manpower authorizations and student throughput. However, the potential savings in manpower reductions and reduced student throughput will come about only if manpower authorizations are actually reduced.

Implementing the following best practices option and gaining its benefits are not straightforward tasks. There are questions about the timing of the increased costs and the benefits and to whom they accrue. In terms of timing, there is a real upfront and continuing budget cost to the METC to begin and maintain the new longer training program for all services. The savings, resulting from needing fewer personnel to perform the same amount of surgical technologist work, accrue only over time as manpower surveys reduce the number of personnel required. These savings will be recouped by the services or the defense health program overall.

We also recognize that a number of other factors would need to be resolved before moving to the following best practices option, including changes in DOTMLPF; concerns about not being able to meet training program requirements in the Air Force; issues about qualifying Air Force and Army faculty as certified surgical technologists to meet accreditation requirements; ensuring that a sufficient number of clinical sites can offer the longer Phase II training; and policies on what to do with individuals who fail to pass the certification examination.

As suggested by the Army, one way to move ahead would be to establish a tri-service task force that builds on the work done by the HC ITO to translate commonalities in the standard of practice into portions of the overall training curricula and also resolves some of the

issues identified above.[2] Common training with a fully consolidated training curriculum should be seen as a long-term goal.

From Common Training to Interoperability

Establishing a common SOP is a necessary prerequisite to common training, which, in turn, is seen as the way to achieve interoperability. For the medical arena, the basic essence of interoperability can be captured in a working definition espoused by the Joint Interoperability Test Command as "the ability of people, procedures, and equipment to operate together effectively and efficiently under all conditions of battle."[3]

Interoperability can occur at several levels. For example:

- Interoperability at the person level refers to the increase in capability that can occur when a service member from one service can be substituted for a service member from another service in their military role. Interoperability at the person level requires that all trained personnel in a specialty are trained to a common level and a common SOP although a service may choose to train beyond that common SOP.
- Interoperability at the unit level refers to the increase in capability that can occur when a unit from one service can be substituted directly for a unit from another service in its military role.
- Interoperability at the forces level refers to the increase in capability that can occur when services operate jointly in the same theater of operations, on the same mission.

At the person level, characteristics (occupational attributes or specifications) can be specified more precisely with less-needed tolerance around the specification. It is possible to have a common standard of practice and common training. Being functionally or occupationally

2 Army comments on initial draft report, July 2008, unpublished.

3 Joint Interoperability Test Command (2001).

interchangeable does not mean an exact replica in every other way—individuals would still wear different uniforms, be inculcated into their own service's values, and have career and retention patterns unique to their service. At this stage, it may only be up to some level (e.g., E-5) or in some settings that mutual substitutability works. As individuals become more senior—particularly, as they move into petty officer and noncommissioned officer leadership roles—it becomes more complex to substitute one for another because conditions change significantly and different tasks emerge (supervision, leadership, and management) even if all the functional surgical technologist tasks remain the same.

For the Military Health System, developing common SOPs and common training offers the means (technical capability), but taking advantage of this technical capability to operate effectively together to enhance overall operational capability requires addressing several DOTMLPF issues.

Achieving common training and training efficiency is a necessary but not sufficient condition for achieving interoperability. It may be that interoperability will be more easily achieved in future years as other "transformational" initiatives are implemented (e.g., use of equipment and systems that are "born joint").

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Abbreviations

AA	associate of arts
AAR	After Action Report
ABHES	Accrediting Bureau of Health Education Schools
ACOL	annualized cost of living
ACS	American College of Surgeons
AETC	Air Education and Training Command
AMCOS	Army Manpower Cost Model
AMEDD C&S	Army Medical Department Center and School
ARC-ST	Accreditation Review Committee on Education in Surgical Technology
ASCAP	Army Civilian Acquired Skills Program
ASCP	American Society for Clinical Pathology
ASD HA	Assistant Secretary of Defense for Health Affairs
AST	Association of Surgical Technologists
BAH	basic allowance for housing
BAS	basic allowance subsistence
BOS	base operating support
BRAC	Base Realignment and Closure
BUMED	Bureau of Medicine and Surgery

CAAHEP	Commission on Accreditation of Allied Health Education Programs
CBRNE	chemical, biological, radiological, nuclear, and explosive
CCAF	Community College of the Air Force
CIHE	Commission on Institutions of Higher Education
CMS	centralized materiel services
CONUS	continental United States
CPR	cardiopulmonary resuscitation
CRNA	certified registered nurse anesthesiologist
CSH	combat support hospital
CSS	Central Sterile Supply
CSSS	Central Sterile Supply Services
CST	certified surgical technologist
DAG	Detailed Analysis Group
DEB	Deputy Executive Board
DMDC	Defense Manpower Data Center
DMSB	Defense Medical Standardization Board
DoD	Department of Defense
DOTMLPF	doctrine, organization, training, materiel, leadership, personnel, and facilities
DPEP	Direct Procurement Enlistment Program
EB	Executive Board
EIPT	Executive Integrated Process Team
EMEDS	Expeditionary Medical Support
EMS	emergency medical services
ENT	ear, nose, and throat

FCCJ	Florida Community College at Jacksonville
FHPC	Force Health Protection Council
FMSS	Field Medical Service School
FORMIS	Forces Management Information System
FOSC	Flag Officer Steering Committee
FST	forward surgical team
FY	fiscal year
HC ITAB	Health Care Interservice Training Advisory Board
HC ITO	Health Care Interservice Training Office
HCO	human capital development
IEO	Interservice Executive Order
IM/IT	information management/information technology
IPT	Integrated Process Team
ITRO	Interservice Training Review Organization
ITRO AHC	ITRO Advisor for Health Care
KSA	knowledge, skills, and abilities
LANTFLT	Atlantic Fleet
METC	medical education and training campus
MHS	Military Health System
MHS-OT	Military Health System Office of Transformation
MLT	medical laboratory technician
MOA	memorandum of agreement
MTF	military treatment facility
NBSTSA	National Board of Surgical Technology and Surgical Assisting
NCCT	National Center for Competency Testing
NCO	noncommissioned officer

NDRI	National Defense Research Institute
NEC	Navy Enlisted Classification
NETC	Naval Education and Training Command
NHTSA	National Highway Traffic Safety Administration
NSHS	Naval School of Health Sciences
O*NET	Occupational Information Network
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
OJT	on-the-job training
OR	operating room
OSD	Office of the Secretary of Defense
PACFLT	Pacific Fleet
POA&M	Plan of Action and Milestones
POI	program of instruction
QDR	Quadrennial Defense Review
QLG	Quick Look Group
RRA	Resource Requirements Analysis
SAC	Senior Advisory Council
SC	Steering Committee
SME	subject matter expert
SMMAC	Senior Military Medical Advisory Council
SOP	standard of practice
SSTR	security, stability, transition, and reconstruction
TAD/TDY	temporary additional duty/temporary duty
TECOM	Training and Education Command
TMY	trained man-years

TIO	Transformation Integration Office
TNCC	Thomas Nelson Community College
TRADOC	Training and Doctrine Command
TS-C	Tech in Surgery—Certified
USD (P&R)	Under Secretary of Defense for Personnel and Readiness
YOS	years of service

CHAPTER ONE

Introduction

As medical staff are becoming more integrated in forward-deployed medical settings, the need for common training and a framework that allows service medical personnel to work together effectively and to know each other's capabilities is becoming increasingly evident. Both the 2005 Base Realignment and Closure (BRAC) Commission and the 2006 Quadrennial Defense Review (QDR) call for the transformation of medical education and training to foster interchangeability and interoperability among medical personnel and units across the services. The BRAC report recommended relocating basic and specialty enlisted medical training to Fort Sam Houston, Texas, to take advantage of economies of scale and the opportunity for joint training. Currently, each service maintains its own medical training/education program at multiple locations.

The final BRAC report recommended the following:

> Realign Naval Air Station Great Lakes, IL, Sheppard Air Force Base, TX, Naval Medical Center Portsmouth, Naval Medical Center San Diego, CA, by relocating basic and specialty enlisted medical training to Fort Sam Houston, TX.
>
> This recommendation also co-locates all (except Aerospace Medicine) medical basic and specialty enlisted training at Fort Sam Houston, TX, with the potential of transitioning to a joint training effort. This will result in reduced infrastructure and excess system capacity, while capitalizing on the synergy of the co-location similar training conducted by each of the three Services. In addi-

> tion, the development of a joint training center will result in standardized training for medical enlisted specialties enhancing interoperability and joint deployability.
>
> Co-location of medical enlisted training with related military clinical activities of the San Antonio Regional Medical Center at Brooke Army Medical Center, Fort Sam Houston, TX, provides synergistic opportunities to bring clinical insight into the training environment, realtime. As a result, both the healthcare delivery and training experiences are exponentially enhanced (pp. 262–263).[1]

At the same time, it is recognized that service-specific training requirements will exist and must be accommodated, provided these are validated by a rigorous review process. The BRAC legislation requires that the recommendations be implemented within six years of being signed into law, i.e., 2011.

To implement the recommendations of the QDR, the Military Health System identified a number of transformation initiatives. QDR Initiative #5 states that "Medical education and training must prepare medical personnel for future requirements, improving overall capabilities and increasing joint medical interoperability and deployability among the services."

The Military Health Service Office of Transformation (MHS-OT), which had been set up for one year by the Under Secretary of Defense for Personnel and Readiness (USD [P&R]) to oversee implementation of the recommendations of the recent commissions and study groups examining medical readiness, including the BRAC law and the medical QDR initiatives, outlined several steps needed to implement these recommendations. These steps included, among others, identification of medical education and training commonalities and service-specific requirements, establishment of a common, core curriculum for joint medical education and training, and identification of best practices.

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1 Defense Base Closure and Realignment Commission (2005).

RAND's Role

RAND's National Defense Research Institute (NDRI) was asked to provide technical and research assistance to facilitate implementation of joint medical training and education. A major focus of the project is to help determine a common standard of practice (SOP) for enlisted medical specialties and to separate out those activities and tasks that might be service-unique rather than common across services. Service-unique activities may arise because of the way the services organize and deploy to provide medical support or because of their unique missions.

An SOP encompasses a set of standardized tasks that individuals who are proficient at a given level must be able to do.[2] Thus, an SOP is linked to a given proficiency level. Often, an SOP delineates the knowledge, skills, and abilities such individuals need to perform competently in the job. To fulfill the directive of QDR Initiative #5, an SOP analysis for medical enlisted occupations needs to be forward-looking to anticipate future requirements and changes in the nature or context of the work.

Focus of Current Study

In July 2007, RAND was asked to focus on the surgical technologist/operating room technician specialty and to define a common SOP for this specialty, which includes the Army's Operating Room Specialist (68D), the Navy's Surgical Technologist (HM 8483), and the Air Force's Surgical Services Apprentice (4N131) and Surgical Services Journeyman (4N151). As the first step in our analysis, we needed to

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2 We distinguish an SOP from scope of practice—a term with which it is often used interchangeably. In the strict sense of the term, a scope of practice is a description of what a licensed individual legally can and cannot do. For example, the National EMS Scope of Practice Model, published by the National Highway Traffic Safety Administration (NHTSA), defines scope of practice for emergency medical services (EMS) personnel as "(d)efined parameters of various duties or services that may be provided by an individual with specific credentials. Whether regulated by rule, statute, or court decision, it represents the limits of services an individual may legally perform" (2006).

decide on a single name for the common capability set across both military and civilian sectors and selected "surgical technologist" as an appropriate title based on the Occupational Information Network (O*NET), which is maintained by the U.S. Department of Labor and is intended to be the nation's primary source of occupational information. Thus, throughout the monograph, the term surgical technologist encompasses the three specialties listed above as well as the traditional civilian surgical technologist occupation.

This monograph outlines a methodology for developing and implementing a common SOP for any enlisted medical specialty at a predetermined level of proficiency and illustrates the use of that methodology by applying it to the surgical technologist specialty. It presents a common SOP for that specialty and then considers issues related to implementation of the SOP. These include:

- identifying options for training or obtaining individuals trained in the common SOP to the desired level of proficiency
- evaluating those options against the BRAC and QDR objectives of efficiency and interoperability and other important objectives such as opportunities to acculturate individuals to service values, beliefs, attitudes, and recruitment and retention
- examining the value of program accreditation and individual professional certification.

When considering the effects of various "make" or "buy" options for surgical technologists on interoperability, we realized that the term "interoperability" was not well-defined in this context. The BRAC and the QDR reports both stated that the longer-term objective of establishing a common SOP and common training for military specialties is to foster the interoperability of individuals, units, and forces across the services to enhance the capability and flexibility of the MHS to deliver both wartime and peacetime missions. Thus, there is a clear assumption that common work and common training inevitably lead to greater interoperability, and this is true, but only at the person level, when individuals become more interchangeable. An important contribution of this monograph is that it highlights the interactions

between common training and interoperability and shows that achieving the former does not automatically lead to the latter. This is because interoperability occurs at multiple levels: person, unit, and force and across multiple domains such as doctrine, organization, and materiel. Developing common work will promote interoperability at the person level but not necessarily at the unit or force level (although it is a necessary first step) because the latter requires that a host of other factors be aligned. To take advantage of the greater interoperability among service members, structural and military factors—equipment and technology, unit structure, service doctrine, and missions—must be aligned and service culture and mindset must be more "joint" than is currently the case.

The remainder of this chapter provides some background on the medical education and training campus (METC) that is being set up at Fort Sam Houston, Texas, and that will be responsible for overseeing and providing enlisted medical training across the services, its governance, and how the RAND work fits into the broader picture.

Medical Education and Training Campus

To fulfill the BRAC recommendation, a joint medical education and training campus is being established at Fort Sam Houston. Currently, the idea is to collocate the three service schools and to consolidate medical training for all services to the extent feasible. The METC will be the world's largest medical education and training institution, with an average daily student load of over 9,000 and a total of 3,600 faculty and staff members. The METC will consolidate most of the medical enlisted training currently being done at Sheppard, Great Lakes, Portsmouth, San Diego, Walter Reed, and the U.S. Army Medical Department Center and School (AMEDD C&S) at Fort Sam Houston. The consolidation and collocation will be undertaken in phases as construction on new instructional facilities and faculty/student housing is completed. The time line for the full stand-up of the METC runs from 2006 through 2011. Ultimately, the METC will be responsible

for training more than 100 enlisted medical specialties and eventually may become a degree-granting institution.

The METC's vision is to become the nation's leader in military medical education and training. Its mission is to produce the world's best military health care personnel to support the nation, by identifying and implementing best practices in joint medical education and training to ensure that medical personnel perform optimally in all environments (medical, military, operational, and expeditionary).[3] A key focus is on establishing common standards of practice to enhance cross-utilization of medical personnel. Historically, the SOP (and hence the training) for allied health personnel in each service has been based on the mission of the service and the force structure. Hence, these different standards and training for individuals who presumably have the same specialty lead to confusion, misunderstanding, and often underutilization of personnel.

An Executive Integrated Process Team (EIPT) is overseeing the setting up of the METC under the guidance of the Flag Officer Steering Committee (FOSC), which comprises flag officers representing each service surgeon general, the Joint Staff, and Joint Forces Command, and the Senior Advisory Council (SAC), which comprises each service surgeon general. In addition, a Transformation Integration Office (TIO) based in San Antonio is responsible for day-to-day operations, assisted by several working groups organized around broad issues (such as academic governance, charter, and organizational structure) and several Integrated Process Teams (IPTs) organized around specific issues—strategic studies, academics, facilities, technology, standard of practice reviews, lifelong learning, joint leader development, and research.

The METC EIPT is also working with the Senior Enlisted Advisory Council and the Health Care Interservice Training Office (HC ITO), which review service training curricula for the medical specialties, looking for commonalities with a view to recommending consolidated training, where feasible. In addition, the METC EIPT has asked federally funded research and development centers such as MITRE

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3 "Draft Charter for the Medical Education and Training Campus" (2007), unpublished.

and RAND to help address various issues related to standing up the METC.

Distinguishing RAND's Role from Training Reviews Being Conducted by the Health Care Interservice Training Office

Over the past two years, the HC ITO has been reviewing enlisted medical training across the services in the various specialties that will be moving to the METC.[4] The office uses the Interservice Training Review Organization (ITRO) process to examine commonalities in training curricula across the services. It facilitates and coordinates all interservice training reviews. The first step in the process is to convene a Quick Look Group (QLG), to determine if sufficient commonality exists between one or more services to warrant a formal study. If the QLG recommends a study, it transitions to a Detailed Analysis Group (DAG). The DAG conducts an extensive analysis of the curriculum and resource requirements with the goal of consolidating/collocating training. Before a decision can be made to consolidate or collocate training, one-time and annual recurring costs must be identified through a Resource Requirements Analysis (RRA) and the services must agree on a course of action. Three major categories of resource requirements need to be estimated—manpower, facilities, and equipment. Cost data produced during the RRA should be the primary focus for DAG recommendations but the DAG can take into account training efficiencies or improvements in training effectiveness that could occur as a result of the proposed change. The work of the HC ITO is overseen by the Health Care Interservice Training Advisory Board (HC ITAB), which identifies the training to be studied, charters the groups to conduct the analysis, and reviews and approves course consolidations. It is chaired by the ITRO Advisor for Health Care (ITRO AHC), who is a Naval medical department flag officer.

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[4] Appendix A provides a more detailed overview of the HC ITO, its role, and its governance structure.

The HC ITO examined the surgical technologist specialty during July 2006–July 2007 and determined that there was sufficient commonality in the didactic (classroom) portion of the services' courses to recommend consolidation of training.[5] The DAG for the specialty met in March 2007 and developed two options for consolidating training for the specialty that were then used by the RRA to develop manpower and facilities estimates.

The RAND work builds on the detailed and methodical analyses done by the HC ITO and other participants at the meeting. However, the RAND tasking is broader than that currently being undertaken by the HC ITO. Although the HC ITO is focused on commonality of training as currently provided, RAND was asked to conduct a more comprehensive examination of what constitutes an occupation, to examine commonality of work across the services rather than training or training curricula, and to analyze the implications of common work and common training for cost and increased interoperability among individuals, units, and forces.

Organization of the Monograph

Chapter Two describes our methodology for defining a common SOP and for evaluating options to train service members to a given proficiency level using different criteria that are important to the Department of Defense (DoD) and the services. We then apply this methodology to the surgical technologist specialty by first documenting the data sources used for the analysis presented in the succeeding chapters. The next three chapters document the results of the analysis. Chapter Three paints a broad-brush portrait of the surgical technologist occupation in both the civilian and military sectors, including the nature of the work and working conditions. Chapter Four defines a common SOP for the specialty and presents four methods to train or obtain qualified surgical technologists:

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5 Health Care Interservice Training Office (2006, 2007a, and 2007b).

- in-house training, including the two variants considered by the DAG and RRA, which differ in both the length of overall training and the length of the didactic and clinical phases
- lateral entry of trained civilians
- outsourcing training to civilian training institutions
- civilianizing the occupation by converting military to civilian billets.

Each option is designed to produce an interoperable, qualified person competent to carry out the tasks in the common standard of practice. Our focus here is largely on in-house training, given the stand-up of the METC. We present the other options for the sake of completeness and because the services might want to consider them in the future. Because issues of program accreditation and individual certification cut across several of the make and buy options, we review these issues at the end of Chapter Four.

Chapter Five evaluates the two variants of in-house training in terms of their likely effects on cost, service culture, recruitment, and retention. Chapter Six presents a brief overview of the other three options, including the pros and cons and likely effects on the objectives noted above.

We then shift the discussion to the broader issue of interoperability and whether and how defining a common SOP and implementing common training is likely to lead to greater interoperability across the services. These issues are examined in Chapter Seven. Chapter Eight presents conclusions and policy implications.

Several appendixes provide supporting documentation. Appendix A gives a brief overview of the HC ITO, its governance, and responsibilities; Appendix B shows the standard of practice for surgical technologists as outlined by the Association of Surgical Technologists (AST); Appendix C contains the data-collection tool that is the underpinning of our cost analyses; Appendix D describes the role and value of accreditation; Appendix E reviews previous studies that focused on estimating the trade-offs between training time and productivity; Appendix F presents the results of our nonlinear estimation of productivity curves; Appendix G reviews previous studies on the buy options discussed in

Chapter Six: lateral entry of trained civilians and outsourcing training; and Appendix H reviews prior work on the conversion of military to civilian billets, largely focused on costing issues.

CHAPTER TWO

Methodology for Defining and Implementing a Common Standard of Practice for a Specialty

To meet the goals of the military, the METC needs an objective way to make policy decisions on combining curriculum that reflect the desires of military leaders and help achieve the objectives of efficiency and greater interoperability. For functional reasons having to do with different service missions, the services might train differently for similar career fields. However, differences may also be due to historical practice and service culture, which may need to be revisited as missions become more "joint."

This chapter outlines a methodology for defining, evaluating, and implementing a common SOP for a given specialty. The methodology consists of three major steps.

Define a Common Standard of Practice for the Specialty

To combine training for a particular career field at the METC, the services must decide on a core set of competencies that students will gain by training to a given level of proficiency. This core set of competencies should have a single occupational title and an accompanying standard of practice. The SOP will define the set of medical activities and tasks that a qualified specialist should be able to perform after being trained, and such training may include some level of on-the-job training (OJT).

It is worth repeating the difference between an SOP and a scope of practice alluded to in the Introduction.[1] As defined here and as generally accepted, a scope of practice is a legal definition of the medical procedures a given medical professional can perform in a given jurisdiction (national or state, depending on the authorizing body). It is the basis for legal actions and liability in civilian medical practice. We prefer to avoid any legal implication by using the term "standard of practice," although we realize that this, too, is subject to misinterpretation because it is used differently in different professions. Nonetheless, for our study, we define the SOP as a comprehensive (but not overly detailed) description of the work that a trained individual is capable of performing—in the case of the METC, work that can be performed by a trained enlisted medical service member.

The SOP is designed to have around 50 activities (defined as an aggregated set of tasks) that together represent a reasonably comprehensive description of the work performed in that specialty. The number is somewhat arbitrary but an examination of various occupational descriptions and task lists suggested that 50 might be both manageable

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[1] The meaning of the terms "scope of practice" and "standard of practice" seems to differ depending on profession. In medicine, standard of practice refers to evidence-based practice guidelines that provide physicians with clear recommendations on how best to evaluate and manage patients with a given disease. Such parameters are based on evidence found in medical literature. (As an example, see American Academy of Sleep Medicine, n.d.) Generally, scope of practice is used in the legal sense, but sometimes "standards of practice" is also used to define legal roles and responsibilities. For example, the Superior Court of the District of Columbia, Administrative Order 03-07, sets the standards of practice for attorneys working with child abuse and neglect cases. These:

> Practice Standards are intended to define the role and responsibilities of counsel in child abuse and neglect proceedings pending in the Superior Court and to improve the quality of representation of children and families with matters under the jurisdiction of the Family Court of the Superior Court;
>
> **NOW, THEREFORE**, it is by the Court,
>
> **ORDERED**, that the Superior Court of the District of Columbia Child Abuse and Neglect Attorney Practice Standards shall take effect on the date of this order and shall govern practice in child abuse and neglect, termination of parental rights, guardianship and adoption proceedings. (Superior Court of the District of Columbia, n.d.).

and descriptive. A smaller list of activities would be easier to compile and would necessarily comprise broader work categories. These broader work categories might be too broad to clearly delineate the nature of the work; in addition, they might not provide sufficient guidance for training curriculum development. A more detailed list might provide more concrete guidance for drafting a training curriculum but it could also potentially lead to greater disagreements on specific tasks or the wording of those tasks.

The SOP is intended to define what trained specialists in that field can be expected to perform, regardless of service affiliation. It is useful for several purposes.

First, the SOP can be used by other professionals in the health field to read and quickly become familiar with the work that a job incumbent can perform. This could be useful for training exercises or for orientations when service members are being introduced and becoming acquainted, so that they can quickly understand how they will work together, thus fostering person-level interoperability.

Second, the SOP can be used as a tool for analysis to assess how different policy decisions involving the career field core competencies will affect military capability. The larger the number of activities that form the common capability set defined by the SOP, the greater the interoperability among the services but, on the other hand, the higher the training costs. Thus, the SOP needs to balance costs, interoperability, and service needs in terms of how these specialists are intended to be used and the work context in which they are employed, using a broader joint force perspective.

Third, the SOP can be used as guidance for curriculum planning at the METC. For activities that are included in the common SOP, curriculum should be combined at the METC. For activities that are outside the common SOP, training at the METC would likely remain service-specific.

The task of defining a SOP for a single specialty consists of the following subtasks:

1. The first step requires developing a generic profile for that specialty as it currently exists by reviewing job descriptions from

each service as well as job descriptions from civilian sources such as the O*NET. This profile provides an overview of the work typically performed by specialists in that field, training, the work context, work demographics, job outlook, and earnings. The ITRO reviews are particularly helpful for describing service commonalities and differences. The profile helps bring to the forefront issues of program accreditation and individual certification.

2. The second step is to gather task lists from a variety of data sources: service training or field manuals or occupational analysis documents and civilian sources such as O*NET and Bureau of Labor Statistics profiles using the O*NET crosswalks that map military specialties to O*NET occupation codes. These task lists form the basis for creating a master list that describes the generic SOP at a medium level of detail. The master list should include critical tasks, knowledge, skills, and abilities (KSAs) needed for the job from each source as well as information on tools and technology used in the job, work context; other occupation-specific requirements of the job (such as education, training, and certification); and information on best practices. The culmination of these tasks will result in a comprehensive description of the generic job in terms of the job-oriented and worker-oriented descriptors.
3. To ensure that the SOP does not simply reflect the world as is but as it might be, a critical third step is to understand the roles that medical personnel and their units will be asked to play in providing support across the full range of military operations and how this might affect those trained in the given specialty.[2] This includes the expanded DoD roles in security, stabil-

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[2] Schippmann (1999) offers some reasons why this kind of "strategic job modeling" is important:

> [I]n many cases, conventional job analysis procedures are too short-sighted to meet the strategic and future-oriented needs of today's organizations . . . decisions about the strategy and direction of the organization will have downstream impacts on work content and worker requirements. The next-generation job analysis approach . . . provides a process for understanding the ultimate objectives of an organization and translating this

ity, transition, and reconstruction (SSTR) operations overseas as well as in providing a range of military support to civil authorities in the United States. This step requires developing a systematic process for obtaining and prioritizing data from published documents, individuals, and groups of individuals about how the job, its requirements, and work context might change. The process begins by expanding on the data previously gathered through reviews of published current and future service and joint doctrine, lessons learned from Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF), and other materials and making decisions regarding their relevance and importance in shaping future requirements or work context for the occupation. This also includes consulting with service leaders about their expectations of how work will change in the future and the implications for work behaviors and KSAs needed for the job. The generic SOP will need to be revisited and the new information regarding job and worker requirements and work context incorporated into the profile to produce a final comprehensive SOP for the occupational specialty.

Validate the Common Standard of Practice

The second major task is to validate the common SOP with groups of subject matter experts (SMEs) both from the services (for example, supervisors) and from the civilian sector. This could be done in a formal Delphi process;[3] it could also be done more informally with groups

information into work requirements. In other words, conventional job analysis procedures frequently provide a past-tense description of something static, while strategic job modeling creates a future-tense description of something changing" (p. x).

[3] Linstone and Turoff (1975, p. 3) define the Delphi process as follows: "Delphi may be characterised as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem." Mullen (2003) offers a useful description of the process: "Delphi usually involves sending a questionnaire, which may be structured or relatively unstructured, to the respondents, who are commonly termed an 'expert panel'. The responses are collated and the original or a revised questionnaire is re-circulated, frequently accompanied by an anonymised summary

of experts from the services, particularly if the specialty is well-defined with reasonable consensus among the services, has a civilian counterpart with a well-defined standard of practice, and accreditation/certification standards set by professional associations or accrediting bodies. The validation process could also include interviews with leaders of professional associations and accrediting bodies to understand the value of accreditation or certification. Once the service SMEs provide input, the research team would need to sort through the comments carefully to make sure that any additional tasks identified by the services represent core competencies and not an expanded standard of practice for advanced professionals or nonmedical responsibilities expected of more senior professionals (for example, training or personnel evaluation), which do not relate to the medical standard of practice.

Identify and Evaluate Options for Achieving a Common Standard of Practice

This third step focuses on how to implement the common SOP and the issues that might arise. In identifying options for obtaining qualified medical specialists, it is useful to be somewhat comprehensive and to examine and compare a range of options including in-house training, hiring trained civilians, outsourcing training, and military-civilian conversion of the occupation. Before we discuss the options, we define the level of proficiency to which the common SOP is pegged and how this differs from the notion of a fully effective worker, which underpins our cost analysis.

of responses. Panellists are invited to confirm or to modify their previous response. This procedure is repeated for a pre-determined number of rounds or until some pre-determined criterion has been fulfilled. Panellists may also be asked to give an explanation or justification for their response. Thus, Delphi typically involves a number of rounds, feedback of responses to participants between rounds, opportunity for participants to modify their responses, and anonymity of responses."

Distinguish Between Proficiency and Productivity

The common SOP is pegged to a level of proficiency—a level of qualification that allows the trained specialist to operate largely independently and to carry out the tasks required in a competent manner. If the occupation has a certification or licensure examination, the level of proficiency could be pegged to the proficiency of a certified or fully licensed individual.

In our analysis, based on earlier RAND work,[4] we make a distinction between a qualified/trained individual and one who is "fully mission-effective." A fully effective worker represents a person who is 100 percent effective at his occupation. For example, the earlier study defined a fully effective worker in the Air Force as shown in Table 2.1.

A person coming out of training will generally require experience in the unit to be "deployable" and considerably more experience to be "fully effective" in the sense of being able to deploy in the forwardmost settings, to deal with unforeseen emergencies, to accept more

Table 2.1
Defining a Fully Mission-Effective Worker

In many career fields, the goal of technical training is to produce a "mission-ready" airman. In addition to technical training skills, a fully mission-effective worker is one who:
you would probably want to send on short notice temporary duty to "base X" to resolve a nebulous, yet difficult, problem with little to no supervision
you can count on to effectively handle most occupation-related situations that arise
knows how to operate effectively in a normal, exercise, or deployed environment
can train junior members effectively and properly document their training
knows how different organizations in the unit work, those organizations' responsibilities, and how those organizations interact with one another to meet mission requirements
can organize or direct others to complete work
is called your "go-to person"

SOURCES: Adapted from Oliver et al. (2002); Manacapilli et al. (2007), Figure 3.1.

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4 Manacapilli et al. (2007).

responsibility as a team member, and to work independently. An important contribution of the RAND analysis is to explicitly account for the costs of advancing the individual from the lower level to the higher level of effectiveness.

Identify Options for Obtaining Qualified Specialists

There are several options for obtaining qualified specialists, although the major focus, given the stand-up of the METC, is likely to be on in-house training. As mentioned above, the "training" includes didactic and clinical training and an OJT component. Presumably, the OJT component will be much shorter for those trained to the required level of qualification at the learning center (for example, those undergoing longer didactic training, longer clinical training, or both) to compensate for shorter clinical training. In the case of the other options, lateral entry for example, there may need to be basic military training and shorter, specialized training in military medicine rather than training in the core medical aspects of the specialty. Outsourcing training might also require a specialized course in military medicine and a specification of the likely average course length in the civilian sector.

Although the National Defense Authorization Act for Fiscal Year 2008 has imposed a moratorium on the conversion of medical billets to civilian positions, it is important to keep this option on the table. For example, over the last few years, the three services had converted or planned to convert about 10,000 military medical and dental positions to federal civilian or contract positions (hereinafter referred to as "civilian" positions). In fiscal year (FY) 2005 through FY 2007, the Army, Navy, and Air Force converted over 5,300 military medical and dental positions to civilian positions and another 4,400 were planned to be converted in FY 2008 and FY 2009.[5] Enlisted positions constituted the bulk of the conversions and planned conversions: 80 percent of positions converted in the FY 2005–FY 2007 time period and 85 percent of those planned for FY 2008 and FY 2009. The Defense Manpower Requirements Report for FY 2008[6] noted that U.S. Code

[5] U.S. Government Accountability Office (2008).

[6] Office of the Under Secretary of Defense for Personnel and Readiness (2007).

Title 10, Section 129c, severely restricted reductions in the number of health care personnel, limiting reductions in the total number of DoD medical personnel to no more than 5 percent from the previous fiscal year, unless the Secretary of Defense certified that these reductions would not result in any increases in the cost of health care services and were in excess of the current and projected needs of the Department (p. 61). Following this, however, because of continued concerns regarding the effect of these conversions on the cost of care and on access to and quality of care, the National Defense Authorization Act for FY 2008 placed a statutory moratorium on all conversions from October 1, 2007, through September 30, 2012. Nonetheless, this issue is likely to be raised in the future as an alternative to training enlisted military personnel to become specialists.

Evaluate the Options

An important part of the analysis is to evaluate these training options against the criteria of cost and productivity; the effect on service culture, recruitment, and retention; and interoperability.

Effect on Costs and Productivity. Training options affect costs in many ways. The most obvious relate to person and facility costs. For example, in completing its RRA for a given specialty, the HC ITO usually considers different training options and then assesses their costs in the following categories: quantity of instructors, average daily student load, student man-years, course length, and net square feet of facility required. Facility costs are embedded in DD Form 1391 for the METC.

Other costs are associated with training options; for example, accreditation and certification costs. If the course is going to be affiliated with the Community College of the Air Force (CCAF), then instructors must have, or be working toward, an associate of arts (AA) degree. If the course is going to be accredited by an accreditation body (for example, the Commission on Accreditation of Allied Health Education Programs [CAAHEP]), then there are direct administrative costs associated with applying for accreditation (preparing a self-study, preparing and hosting a site visit, etc.).

Several other factors enter the cost analysis.

One category of costs has been largely ignored in favor of the more immediate, near-term, and easily measurable costs. This category encompasses costs associated with the individual's reduced level of productivity as he or she trains to the required level of proficiency. For example, some training options can require a significant OJT portion, and this is the current philosophy of the Air Force. During the OJT portion of training, a student works at a unit but presumably works at a lower level of proficiency than a student who trained to a higher level of proficiency in a "classroom" setting.

The productivity costs of different training options can be measured in several ways. Productivity at different times in a person's career can be measured as a percentage of the productivity of a fully mission-effective individual, where, as shown above, "fully mission-effective" is defined variously as "being able to operate effectively in any environment," "being able to organize or direct others to complete the work required," and "being the go-to person." The productivity of a fully mission-effective worker (set at 100 percent) is well beyond the productivity of a "qualified" individual and requires much more seniority and experience. A cost analysis also needs to take into account retention patterns to account for the length of time needed for the service to recoup its costs.

Training options also may affect costs at the forces level, as different training options can affect the required number of personnel and thus accessions. For example, some training options can produce graduates with a larger core capability set than other training options. If a training option allows graduates to work unsupervised, then some military units may be able to reduce the manpower allocated for supervision. Eventually, because the trained individuals are more productive, overall manpower could be reduced.

The extent to which these savings in reduced manpower are likely to be realized depends on where and how the medical enlisted personnel are employed. If, for example, a small outpatient clinic requires a surgeon, a nurse, and a surgical technologist to be viable, then it would be difficult to justify the reduction of the surgical technologist position based simply on overall numbers. This has sometimes been referred to

as an "integer problem." However, most surgical technologists, as we show below, work in large installations.

Effect on Service Culture. Service culture encompasses the values, attitudes, and beliefs that affect the behaviors of enlisted medical personnel and it is important for unit cohesiveness and commitment. Training options—especially those calling for consolidation—are likely to have an effect on service culture. It is possible that by attending joint medical training courses, enlisted medical personnel may experience a decreased exposure to service culture. However, many steps can be taken at the METC in conjunction with the training options to ensure that service culture is instilled in and retained by service personnel. Further, enlisted and commissioned personnel in medical career fields and from different services often train together for reasons of interoperability and economy, without necessarily adversely affecting their service culture.

This consideration becomes more important when examining buy options, e.g., lateral entry or outsourcing training, where the chances to acculturate to the values and beliefs of a service may be reduced.

Effect on Recruitment and Retention. Training options may affect recruitment and retention and also the career progression of personnel in the enlisted medical career fields. A training option can affect recruitment in a career field in two ways. For recruits enlisting in the military with no prior medical experience, recruitment may be more appealing if the training options present the recruit with a satisfying career in the military and increase their employability in the civilian sector after separation from the military. Recruiting may also increase if enlistees who are already trained to the proficiency skills required by the core capability set are given credit for their training and allowed to enter at higher pay grades or given enhanced promotion opportunities.

Training options may affect retention and the career progression of personnel in enlisted medical career fields. If training options produce graduates with skills and credentials that are in high demand by civilian employers, retention may decrease. If training options produce graduates with capabilities that can lead to positions of leadership in

the enlisted ranks, and successful middle- and late-career assignments in the military, then retention may increase.

Effect on Interoperability. Interoperability at the person level will be higher when individuals are trained to a common set of competencies using common training than with the current system of service-unique training and standards. Trained medical specialists across the services will be able to perform more tasks in a similar way, will have experienced the same training on these tasks, and will have spent more time training with specialists from other services and working with medical professionals from other services. The effect of all common training options on interoperability is positive. The degree of increased interoperability at the person level will depend on whether there are scenarios or environments in which service members have the opportunity to interact with service members from other services—for example, at hospitals where all three services are working together (such as at Landstuhl).

However, the potential increase in capability in terms of greater flexibility in deployment of units and people is not likely to be realized without changes in doctrine, military structure, and military factors. We discuss this in Chapter Eight.

Summary

This chapter outlines a process for defining and implementing an SOP for a given specialty. The process consists of three major analytical tasks:

1. Define a Standard of Practice for the Specialty

- Develop a generic profile for that specialty as it currently exists by reviewing job descriptions from each service as well as job descriptions from civilian sources such as the O*NET.
- Select a desired proficiency level for the specialty.
- Develop a common SOP at the desired proficiency level, which describes the generic SOP at a medium level of detail (for example, 50 activities). The master list should include critical tasks and KSAs needed for the job.

- Include information on how work will change in the future and the implications for work behaviors and KSAs needed for the job.

2. Validate the Common Standard of Practice

- Consult with service SMEs and experts from the civilian sector to validate the SOP either formally or informally.
- Ensure that additional tasks identified by the services represent core competencies and not an expanded standard of practice for advanced professionals or nonmedical responsibilities expected of more senior professionals, which do not relate to the medical standard of practice.

3. Identify and Evaluate Options for Achieving a Common Standard of Practice

- Identify options for achieving the desired proficiency level for the specialty.
- Evaluate these options against the criteria of cost, effect on service culture, recruitment and retention, and interoperability.
- Identify issues related to program accreditation and professional certification, if relevant.

Apply the Methodology to the Surgical Technologist Specialty

We now turn to the application of this methodology to the surgical technologist specialty. Before describing the process and results of the analysis, we first document the variety of data sources we used for the study. We list them below, organized by the three analytical tasks constituting the methodology.

Profile of the Occupation

To characterize the civilian occupation, we used the following data sources:

- Bureau of Labor Statistics, *Occupational Outlook Handbook, 2008-09 edition,* Washington, D.C., 2008 (http://www.bls.gov/oco/pdf/ocos106.pdf)
- American Medical Association, *Health Professions Career and Education Directory 2007–2008,* 35th Edition, Chicago, Ill., 2007
- Linda Montgomery and Kriste L. Marhefka, *Job Analysis for Certified Surgical Technologists and Certified First Assistants,* Colorado Springs, Colo.: The Chauncey Group International, May 2002
- Phone interviews with organizations overseeing program accreditation (CAAHEP, Accreditation Review Committee on Education in Surgical Technology [ARC-ST], and Accrediting Bureau of Health Education Schools [ABHES]) and those offering professional certification (National Board of Surgical Technology and Surgical Assisting [NBSTSA] and National Center for Competency Testing [NCCT])
- Web sites of the organizations listed above (http://www.ast.org/, http://www.arcst.org/, http://www.nbstsa.org/, http://www.ncctinc.com/, and http://www.caahep.org/, and http://abhes.org/)

Data sources for the military occupations included:

- Minutes of the Quick Look Group, the Detailed Analysis Group, and the Resource Requirements Analysis group convened by HC ITO[7]
- Department of Defense Occupational Database maintained by the Defense Manpower Data Center (DMDC)
- Forces Management Information System (FORMIS) maintained by DMDC
- Office of the Secretary of Defense (OSD) military compensation Web site (http://www.dod.mil/cgi-bin/rmc.pl)

7 See Health Care Interservice Training Office (2006, 2007a, and 2007b).

Standard of Practice Analysis

We used the following for developing the common standard of practice:

- Minutes of the Quick Look Group, the Detailed Analysis Group, and the Resource Requirements Analysis group convened by HC ITO[8]
- Service-specific descriptions, analyses, and training curricula for the surgical technologist specialty: Air Force Occupational Measurement Squadron occupational analyses, Navy Job Task Analysis, and Army Soldier's Manual and Training Guide (Army STP 8-91D14-SM-TG)
- United Kingdom's Defence Medical Education and Training Agency, *Operational Performance Statement for Operating Department Practitioners,* Final Draft, May 10, 2006
- Bureau of Labor Statistics, *Occupational Outlook Handbook,* 2008-09 edition, Washington, D.C., 2008 (http://www.bls.gov/oco/pdf/ocos106.pdf)
- Occupational Information Network (http://online.onetcenter.org/link/summary/29-2055.00)
- Association of Surgical Technologists, *Core Curriculum for Surgical Technology,* 5th edition, Littleton, Colo., 2006
- Comments from SMEs participating in the Standard of Practice IPT
- Linda Montgomery and Kriste L. Marhefka, *Job Analysis for Certified Surgical Technologists and Certified First Assistants,* Colorado Springs, Colo.: The Chauncey Group International, May 2002
- American Medical Association, *Health Professions Career and Education Directory 2007–2008, 35th Edition,* Chicago, Il., 2007
- Phone interviews with organizations overseeing program accreditation (CAAHEP, ARC-ST, and ABHES) and those offering professional certification (NBSTSA and NCCT)

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[8] See Health Care Interservice Training Office (2006, 2007a, and 2007b).

- Web sites of the organizations listed above (http://www.ast.org/, http://www.arcst.org/, http://www.nbstsa.org/, http://www.ncctinc.com/, http://www.caahep.org/, and http://abhes.org/)

Identify and Evaluate Options for Obtaining Qualified Surgical Technologists

The options for obtaining qualified surgical technologists were based on the following:

- Minutes of the Detailed Analysis Group and the Resource Requirements Analysis group convened by HC ITO to identify the two in-house training options
- Reviews of prior studies that had examined the advantages, disadvantages, and service experience with hiring trained civilians, outsourcing training, and civilianizing military billets.

To estimate the productivity of enlisted personnel as they progressed through the surgical technologist program and at different points in their career, we collected original data, as outlined below:

- Service supervisors and senior surgical technologists (E-5 and above) were asked to fill out a simple data-collection tool.

For the cost analyses, we used the following data sources:

- Office of the Under Secretary of Defense (Comptroller), service-specific FY 2008 Department of Defense Miltary Personnel Composite Standard Pay and Reimbursement Rates (http://www.defenselink.mil/comptroller/rates/fy2008/2008_k.pdf, accessed on February 15, 2008)
- Army Manpower Cost Model (AMCOS)
- Air Force Cost Factors (Air Force Instruction 65-503)
- Robert A. Levy, Eric W. Christensen, and Senarnu Asamoah, *Raising the Bonus and the Prospects for DOD's Attracting Fully Trained Medical Personnel,* Alexandria, Va.: Center for Naval Analyses, 2006

CHAPTER THREE

A Current Profile of the Surgical Technologist Specialty

This chapter outlines what we know about the surgical technologist occupation as it is currently structured. For the military, the specialty encompasses the Army's Operating Room Specialist (68D), the Navy's Surgical Technologist (HM 8483), and the Air Force's Surgical Services Apprentice (4N131) and Surgical Services Journeyman (4N151). We profile the occupation by outlining the nature of the work that surgical technologists perform, their working conditions, training and other qualifications, employment, job outlook, and earnings. We do this for the civilian and military sectors separately within each section. These provide the context for the analyses in subsequent chapters.

Nature of the Work

Civilian

The surgical technologist is an integral member of the team of medical practitioners providing surgical care to patients in a variety of settings. The *Occupational Outlook Handbook*, 2008–09 edition, published by the Bureau of Labor Statistics, describes the nature of the work done by a surgical technologist as follows:

> Surgical technologists, also called scrubs and surgical or operating room technicians, assist in surgical operations under the supervision of surgeons, registered nurses, or other surgical personnel. Surgical technologists are members of operating room teams,

> which most commonly include surgeons, anesthesiologists, and circulating nurses.
>
> Before an operation, surgical technologists help prepare the operating room by setting up surgical instruments and equipment, sterile drapes, and sterile solutions. They assemble both sterile and nonsterile equipment, as well as adjust and check it to ensure it is working properly. Technologists also get patients ready for surgery by washing, shaving, and disinfecting incision sites. They transport patients to the operating room, help position them on the operating table, and cover them with sterile surgical "drapes." Technologists also observe patients' vital signs, check charts, and assist the surgical team with putting on sterile gowns and gloves.
>
> During surgery, technologists pass instruments and other sterile supplies to surgeons and surgeon assistants. They may hold retractors, cut sutures, and help count sponges, needles, supplies, and instruments. Surgical technologists help prepare, care for, and dispose of specimens taken for laboratory analysis and help apply dressings. Some operate sterilizers, lights, or suction machines, and help operate diagnostic equipment.
>
> After an operation, surgical technologists may help transfer patients to the recovery room and clean and restock the operating room.

Surgical technologists may also work as circulators. A circulator is the "unsterile" member of the surgical team who

> interviews the patient before surgery; prepares patients; helps with anesthesia; obtains and opens packages for the "sterile" persons to remove the sterile contents during the procedure; keeps a written account of the surgical procedure; and answers the surgeon's questions about the patient during the surgery.

Some surgical technologists work on the supply side, for example, managing central supply departments in hospitals or working with firms that provide sterile supply services or operating equipment.

In addition, technologists can specialize in a particular area of surgery, such as neurosurgery or open heart surgery. With additional training, technologists can advance to first assistants, who have greater responsibilities in the operating room (for example, helping with retracting, sponging, suturing, cauterizing bleeders, and closing and treating wounds).

Military

Surgical technologists working in the services have jobs that are very similar in scope to those of civilian surgical technologists. For example, the DoD Occupational Database describes the functions performed by the technicians in the three services as follows:

Air Force

> Participates in, and manages planning, providing, and evaluating surgical patient care activities and related training programs. Organizes the medical environment, performs and directs support activities in patient care situations, including contingency operations and disasters. Assists professional staff in providing patient care for the surgical patient before, during, and after surgery. Performs scrub and circulating duties in the operating room (OR). Assists with post-anesthesia recovery of patients. Processes, stores, and distributes sterile supplies. Participates in planning, implementing, and evaluating management activities related to the OR and Central Sterile Supply Services (CSSS). Performs duties in and supervises the urology, orthopedic, and otorhinolaryngology surgical specialties.

Army

> The operating room specialist assists the nursing staff in preparing the patient and the operating room (OR) environment for surgery . . . providing assistance to the medical staff during surgical procedures. They also operate the centralized materiel services (CMS) and are responsible for preparing and maintaining sterile medical supplies and special equipment for medical treatment

> facilities. The operating room specialist also assists in the management of operating room suites.

Navy

> Assists medical officer in carrying out surgical techniques. Provides nursing care, safety and support to patients before, during and after surgery. Selects, sterilizes and prepares instruments and materials and the aseptic environment necessary for surgery. Assists anesthetist during operating procedures in giving artificial respiration and in the use of resuscitators. Maintains surgical equipment and records. Assists with instruction, supervision, and evaluation of students and other corpsmen assigned duties relating to surgery.

In addition, service members working in this specialty need a separate set of skills, for example, how to set up and take down surgical tents, maintain asepsis, perform patient transfer under field conditions, and other medical readiness activities that do not fall into the standard of practice of a civilian surgical technologist.

Working Conditions

Civilian

In the civilian sector, most surgical technologists work in hospitals, "principally in the surgical suite and also in emergency rooms and other settings that call for knowledge of, and ability in, maintaining asepsis, such as materials management and central service."[1] Surgical technologists also work in outpatient surgicenters and clinics.

Military

In the military, surgical technologists are employed both in military treatment facilities, where they may work in the surgical suite or in

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[1] American Medical Association (2007), p. 438.

clinical settings, or aboard Navy ships. Many of those working in clinics tend to be surgical technologists with skills and training in particular specialties (such as urology, anesthesia, surgical supply [logistics], and orthopedics). During wartime, they may be with deployed medical units working under field conditions and potentially in hostile environments. Most work in hospital and clinic settings.

Training and Other Qualifications

Civilian

A variety of institutions offer formal training in surgical technology, including community and junior colleges, vocational schools, universities, and hospitals. The *Occupational Outlook Handbook* provides a succinct description of the training that surgical technologists receive:

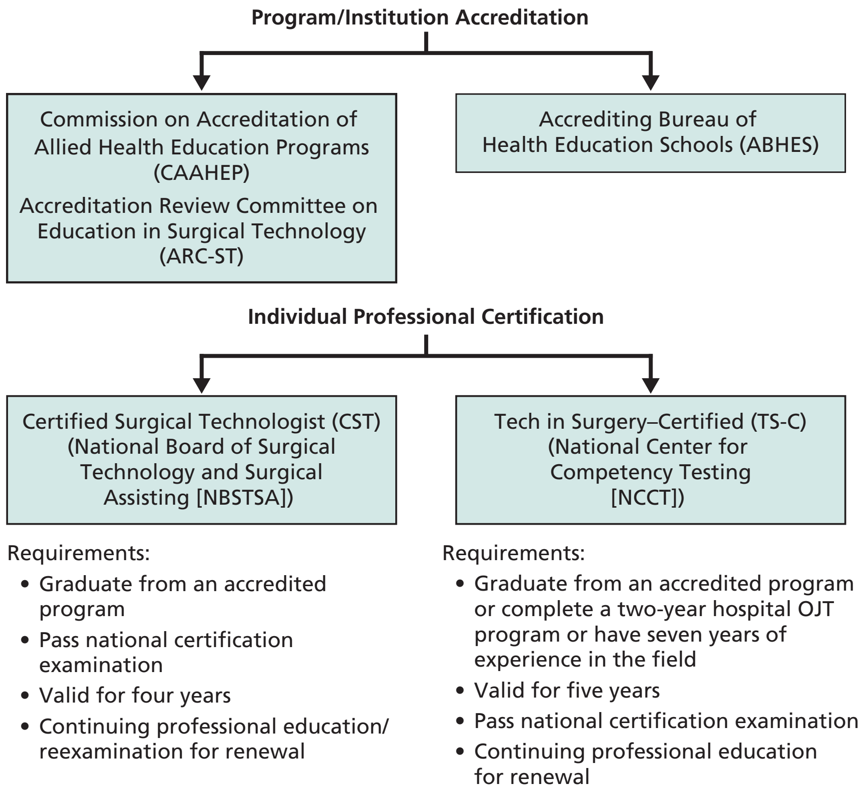
> Programs last from 9 to 24 months and lead to a certificate, diploma, or associate degree. High school graduation normally is required for admission. Recommended high school courses include health, biology, chemistry, and mathematics.
>
> Programs provide classroom education and supervised clinical experience. Students take courses in anatomy, physiology, microbiology, pharmacology, professional ethics, and medical terminology. Other studies cover the care and safety of patients during surgery, sterile techniques, and surgical procedures. Students also learn to sterilize instruments; prevent and control infection; and handle special drugs, solutions, supplies, and equipment.

Program Accreditation

Figure 3.1 gives an overview of the various professional bodies providing accreditation and individual profession certification.

In 2006, over 450 programs across the United States were accredited by CAAHEP. These programs graduate about 7,000 people a year. In addition to CAAHEP, ABHES is recognized by the U.S.

Figure 3.1
Accreditation and Certification Bodies



NOTE: All programs are required to follow AST's *Core Curriculum for Surgical Technology*.
RAND *MG774-3.1*

Department of Education as an accreditor of private, postsecondary institutions in the United States offering predominantly allied health education programs and as the programmatic accreditor of medical assistant, medical laboratory technician, and surgical technology programs leading to a certificate, diploma, associate of applied science, associate of occupational science, or academic associate degree, including those offered via distance education. Accredited programs are required to follow the *Core Curriculum for Surgical Technology*, published by the Association of Surgical Technologists (AST). The handbook does not

mandate clock hours for either the didactic or the clinical portions of the training, although our interview respondents mentioned that historical data suggest that clinical contact needs to be greater than 500 hours to achieve the level of experience and familiarity with the variety of cases surgical technologists are likely to encounter. ARC-ST's standards are, therefore, broadly written for allow for creativity and individual program emphases. In terms of the clinical requirement, the 5th edition of the handbook does not establish a number of clock hours but rather the types of cases and procedures and the level of responsibility taken on by the surgical technologist. Cases are divided into core and specialty areas and levels within those areas that reflect the complexity of the procedure. The guidelines in the handbook are for the number of cases and the types and levels of these cases. For example, the minimum clinical requirement for a program is 80 first scrubbed cases (assisted or solo) with at least 25 of these being solo; the standard clinical requirement is 125 first scrubbed cases with 35 being solo; and the best clinical requirement is 140 cases with 40 of them being solo. Page 251 of the handbook describes the make-up of these cases in terms of core versus specialty areas and case levels.

Many hospitals also offer formal and informal programs with a large on-the-job training component to train surgical technologists, because of perceived shortages.[2]

Professional Certification

Surgical technologists may obtain voluntary professional certification in one of two ways. NBSTSA (formerly the Liaison Council on Certification for the Surgical Technologist) awards the CST designation to those who graduate from an accredited program and pass their national certification examination. Certification needs to be renewed every four years and requires continuing education or reexamination.

Certification also may be obtained from the NCCT, which awards the TS-C (NCCT) designation to those who pass the NCCT national examination for surgical technologists. To qualify for the exam, candidates must complete an accredited training program or undergo a two-

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[2] Information provided by interview respondents.

year hospital on-the-job training program. Individuals with seven years of experience working in the field are also qualified to take the examination as are other health professionals with extensive documented scrub experience (doctors, registered nurses, licenses practical nurses, and licensed vocational nurses). Certification is valid for five years and NCCT requires 14 hours of approved continuing education annually, or 70 hours within that five-year period of time, for recertification.

A survey of certified surgical technologists in 2002 revealed that about 58 percent had been trained in a surgical technologist certificate/diploma program and 14 percent had graduated from a surgical technologist associate degree program. About 14 percent had received on-the-job training and 9 percent had been trained by the military.[3]

Military

The material in this section is based on the reports produced by the review groups (QLG, DAG, and RRA) convened by the HC ITO.

Air Force. The Surgical Services Apprentice (4N131) course consists of 351.5 hours of Phase I didactic training at Sheppard Air Force Base, and 240 hours of Phase II clinical training at one of six sites. The Phase I training includes a 24-hour Expeditionary Medical Readiness section. The projected FY 2007 throughput is 116 students. Students earn CCAF credit hours while taking the Surgical Service Apprentice course. Most students come to the 4N131 course after basic training. The Air Force course was accredited by CAAHEP in the past, but this is no longer the case. Therefore, students are not eligible to sit for the NBSTSA's CST exam. The Air Force decided to voluntarily withdraw from CAAHEP accreditation because of cost considerations and because NCCT offered a less-expensive and comparable alternative.[4] Students are eligible to sit for the NCCT's Tech in Surgery exam upon Phase II graduation, but the Air Force recommends that students take the exam after receipt of 5-skill (journeyman) level, i.e., at about two

[3] The very low response rate on the survey makes these data somewhat suspect but we report them here simply because there is little hard evidence on this subject. See Montgomery and Marhefka (2002).

[4] Air Force comments on an unpublished initial draft report, July 2008.

years of service on average. Instructors for the Air Force course do not need to be CST-certified, but they do need to have an associate degree or to obtain one within a year of assignment to instructor duty for the course to maintain accreditation by CCAF. The Air Force is concerned that its instructors would need to attend a bridge program to acquire CST certification to teach a CAAHEP-accredited course. Although the Phase I training would require only a little modification to meet CAAHEP standards, Phase II training would likely require significant modification. The Air Force recently revised its Phase I and Phase II courses. Phase I training increased by 16.5 hours and Phase II training by 16 hours as of November 26, 2007. The Air Force sends select 5-skill-level surgical technologists for more specialized training within an occupational area (for example, urology, orthopedics, or otolaryngology). In the Air Force lexicon, these are known as "shreds." As of FY 2007, nine graduates were selected to receive this specialized training upon graduation from initial skills training.[5]

The Air Force wants to maintain training in Central Sterile Supply (CSS) but is concerned because that training requires smaller class sizes and more iterations to meet accession requirements. It is also concerned that the new Department of Nursing facility at Fort Sam Houston will not be large enough to handle tri-service student loads. The Air Force would also like to maintain control of its own Phase II training, but it would like to use sister services' sites as well to allow students access to the required number of surgical cases necessary for NBSTSA certification.

Army. The Operating Room Specialist (68D) course consists of nine weeks of Phase I didactic training at AMEDD C&S, followed by 10 weeks of Phase II clinical training at one of 14 sites. The projected FY 2007 throughput is 300 students. Included in the nine-week Phase I training is a 72-hour Field Training Exercise. Most students entering the course are Initial Entry Training students, and a significant number of them are in the reserve (40 per class). At one time, the course was CAAHEP-accredited, but the Army chose to move away from this accreditation as requirements became more difficult to meet.

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5 Air Force comments on an unpublished initial draft report, July 2008.

As a result, students are not eligible to sit for the NBSTSA's CST exam. However, they are eligible to sit for the NCCT Tech in Surgery exam after graduation from the 68D course. The Army has expressed concern that its instructors would need to participate in a bridge program to acquire CST certification to teach a CAAHEP-accredited course. Although Phase I training would require only a little modification to meet CAAHEP standards, Phase II training would likely require significant modification. The Army also wants to maintain CSS training, because its 68D soldiers are required to perform CSS tasks. The Army is concerned about the limited number of clinical training opportunities in San Antonio.

Navy. All corpsmen attend recruit training on entering the service. After recruit training, prospective medical enlisted staff attend training at the Naval Hospital Corps School, which is a Navy "A" school that provides primary specialty training. The Hospital Corpsmen (HM) "A" school, at Great Lakes, Illinois, offers a course approximately 13 weeks long, which provides the basic principles and techniques of patient care and first-aid procedures, including cardiopulmonary resuscitation (CPR) training.

On graduation, the HM is awarded the Navy Enlisted Classification (NEC) (a code that identifies a skill, knowledge, aptitude, or qualification) of 0000. Hospital corpsmen can also receive specialized training as surgical technologists, medical laboratory technicians, radiology technicians, aviation/aerospace medicine specialists, etc. This advanced education is done through "C" schools, which provide additional NECs. The Navy uses primary and secondary NECs. For example, a hospital corpsman who completes surgical technologist training is awarded the 8483 NEC, with the secondary NEC of 0000. Some surgical technologists attend the Navy's "C" school directly from the HM "A" school, whereas others apply to and are accepted into "C" school from the fleet. Most students entering the program come from the HM "A" (corpsman) school.

The surgical technologist (HM 8483) course consists of 394 hours of Phase I didactic training at NSHS San Diego and Portsmouth, followed by 600 hours of Phase II clinical training at one of five sites. The projected FY 2007 throughput is 312 students. Additionally, all HM

8483 students are required to attend the six-week Field Medical Service School (FMSS). The HM 8483 course is accredited by CAAHEP and course graduates may sit for the CST exam. According to CAAAHEP requirements, instructors must be CST-certified to teach the course. The Navy medicine force structure requires that surgical technologists perform as first assistants in many billets, which demands a higher level of knowledge and is considered to be beyond the qualified level of proficiency to which we pegged our common SOP. The Navy wants to maintain training in CSS as well. The Navy is concerned about the lack of appropriate clinical opportunities in San Antonio, particularly since CAAHEP accreditation demands that students complete procedures as a circulator and a scrub. The Navy is also concerned that the new Department of Nursing facility at Fort Sam Houston will not be large enough to handle tri-service student loads.

Workforce Demographics

Civilian

In 2006, there were approximately 86,000 surgical technologists. Of this group, 33 percent have a high school diploma, 50 percent have some college, and 17 percent have a college degree. Surgical technologists have on average nine years of experience in the field. Some will stay as surgical technologists throughout their careers; some will become surgical assistants; some will become educators and trainers; and most will eventually specialize. About 31 percent are certified. Very few states have requirements for certification as a condition of employment. A brief sampling of hiring practices by leading hospitals across states shows varied practice with respect to certification. Most cite certification as desired but not required.

In 2005, 3,762 candidates attempted the NBSTSA's national certification exam for surgical technologists. The pass rate was 66 percent (2,475 passed). NBSTSA and AST reported that there are currently 24,000 CSTs actively employed in the field, who accounted for 31 per-

cent of all employed surgical technologists.[6] Of these, about 250–500 certificants had been certified before 1977 and were granted certification for life through board action.[7]

Of the 2,000–2,500 who take the NCCT examination, about 75–80 percent pass. NCCT offers students three opportunities to take or retake the examination, requiring them to wait three months between retakes.

Military: Grade and Experience Distribution

In each service, the workforce is composed of personnel in the active and reserve components. Table 3.1 shows the grade distributions and total numbers for each service.

Slightly fewer than 5,000 enlisted personnel are surgical technologists. Of this number about one-third are reservists but this varies by service. Sixty percent of Army specialists are reservists; 23 and 24 percent are reservists in the Navy and Air Force. Of all reservist surgical technologists, about 70 percent are in the Army.

The experience of surgical technologists also varies by service as shown in Figure 3.2. Because the services seem to move their senior surgical technologists into management or supervisory roles and to have different policies for retaining the specialty code, we do not show data for beyond 20 years of service.

On average, Air Force surgical technologists are more experienced and those in the Army less experienced. The figure also shows the difference in experience at entry into the field. Because Navy personnel attend other training and may have fleet experience before completing surgical technologist training, they tend to have more experience at entry than personnel in the other services. Thus, although 15 percent of the Air Force and 25 percent of the Army surgical technologists are in their first year of service, this is true of about only 3 percent of the

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[6] If we use the number provided earlier by the Bureau of Labor Statistics (86,000 currently employed surgical technologists), then certified surgical technologists account for a slightly smaller percentage (28 percent) than reported by the association.

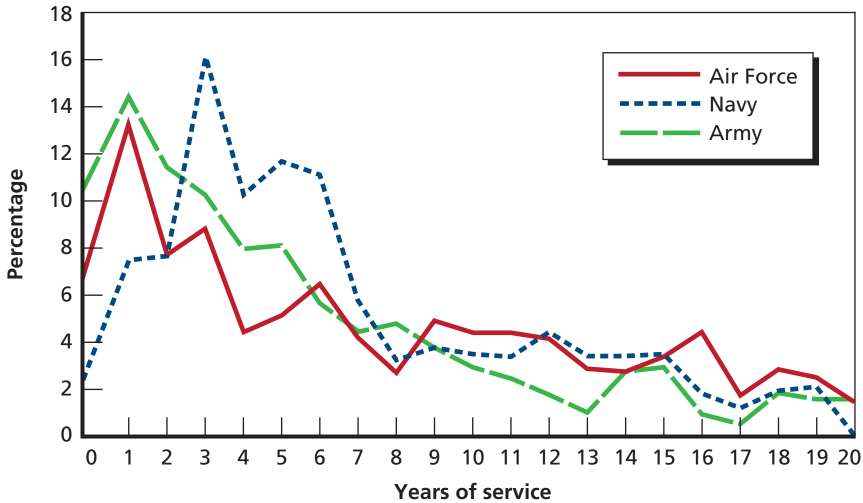
[7] We do not have similar numbers for the NCCT candidates.

Table 3.1
Distribution of Service Personnel Within Surgical Technologist Functional Area Military Occupational Specialty/Air Force Specialty Code/Navy Enlisted Classification, by Pay Grade and Service, December 2006

	E-1–E-4	E-5–E-6	E-7–E-9	Total	% of Total
Army: operating room specialist (68D)					
U.S. Army	736	314	53	1,103	44
Army National Guard	36	19	2	57	2
U.S. Army Reserve	709	533	131	1,373	54
Total	1,481	866	186	2,533	
% of total	58	34	7		100
Air Force: surgical service technician					
U.S. Air Force	295	385	100	780	74
Air National Guard	14	12	2	28	3
Air Force Reserve	139	87	25	251	24
Total	448	484	127	1,059	
% of total	42	46	12		100
Navy: surgical technologist (HM 8483)					
U.S. Navy	518	411	13	942	77
U.S. Naval Reserve	121	122	37	280	23
Total	639	533	50	1,222	
% of total	52	44	4		100

SOURCE: Defense Manpower Data Center.

Figure 3.2
Experience Distribution of Surgical Technologists, by Service and Years of Service, December 2006



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Navy surgical technologists. Differences in the experience distribution make a difference in the evaluation of options for producing surgical technologists.

In each service, personnel progress through a career of about 20 years, longer for some. As personnel gain experience and move to higher pay grades (E-5 and above), they begin to take on more difficult tasks and more supervisory and administrative duties. Some also begin to specialize within the surgical technologist area, become educators or trainers or career managers, or move to other related occupations. Our civilian respondents told us that this was a typical career pattern for civilian surgical technologists as well.

For our analysis of options, we are interested in how best to commonly produce qualified surgical technologists. The Air Force distinguishes among apprentices, journeymen, and craftsmen and higher as levels of occupational proficiency. Virtually all apprentices are at grade E-4 and below. About 85 percent of journeymen are at E-4 and below. Thus, for purposes of our analysis, we consider all personnel at E-4 or

below to be journeymen or progressing to that status. This represents about 67 percent of all Army surgical technologists, 55 percent of Navy surgical technologists, and 38 percent of Air Force surgical technologists. The Air Force has more experienced surgical technologists overall and more highly graded ones (at the craftsman level) as a result.

Employment

Civilian

The Bureau of Labor Statistics reported that of the approximately 84,000 surgical technologists in 2004, 70 percent worked in hospitals, mainly in operating and delivery rooms. The remainder worked in the offices of physicians or dentists who perform outpatient surgery and in outpatient care centers, including ambulatory surgical centers. A few worked as "private scrubs," employed directly by surgeons with special surgical teams, such as those for liver transplants.

Military

Similar to civilian surgical technicians, most military surgical technicians are assigned to definitive care/hospital setting.

Air Force. The Air Force has approximately 650 active component authorizations for surgical technologists, and virtually all are authorized in hospitals or larger clinics. About 53 percent of authorizations are for E-4s and below. The Air Force has large medical centers and hospitals where surgical technologists are clustered. In fact, 61 percent of all E-4s and below are authorized at only four medical centers and three large hospitals ranging from 21 to 50 authorizations for E-4s and below and 41 to 82 authorizations for all grades. In terms of deployable medicine, the Air Force has a tiered structure. The two most forward tiers (field surgical teams and Expeditionary Medical Support [EMEDS] basic units) have no surgical technicians authorized. The next two tiers (EMEDS + 10 and EMEDS + 25) have one 4N151 and two 4N151, respectively, for a total of 46 in the two tiers. These authorizations, if all were deployed at any one time, account for only 7 percent of total surgical technologist authorizations.

Army. The Army has approximately 800 active component authorizations for surgical technicians.[8] Seventy-six percent of all surgical technologist authorizations are in the medical activities or medical centers of the Medical Command that constitute virtually all of the medical structure of the Army except field units. The remaining 24 percent of authorizations are in field units assigned to Army service component commands, such as U.S. Army Europe or Forces Command. These field units are primarily of two types: combat support hospitals that provide definitive care and forward surgical teams that provide forward resuscitative surgery. About 18 of these teams are in the active component, and these teams are each authorized more experienced personnel: one E-4, one E-5, and one E-6.[9] These forward surgical teams (FSTs) account for only 7 percent of total authorizations. Seventeen percent of all authorizations are thus in the combat support hospitals (CSHs); all E-3s not in the Medical Command are assigned to CSHs, and there are only 33 of them. Overall, 56 percent of all surgical technologist authorizations are for E-4s and below. Of these, 82 percent of the more junior personnel E-3s and 82 percent of E-4s are authorized in the Medical Command and all are in medical activities or medical centers (clinics or hospitals). Except for the 7 percent of authorizations in FSTs, 93 percent of all surgical technologists work in a definitive care setting.

Navy. The Navy has approximately 1,030 active component authorizations for surgical technologists in units. Eighty-three percent of all surgical technologist authorizations are in the medical treatment facilities or hospitals of the Bureau of Medicine and Surgery (BUMED). The other 17 percent of authorizations are in units assigned to the Marine Corps (10 percent) and the Atlantic and Pacific Fleets (LANTFLT and PACFLT, respectively) (3.5 percent each). The units in the Marine Corps include forward resuscitative surgical teams and surgical companies that are part of the medical battalion. Each company has approxi-

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8 All data are current as of the end of FY 2006 and are from FORMIS, which is maintained by the Defense Manpower Data Center.

9 Although some positions are authorized a higher grade, personnel of a lower grade (and experience) may be assigned to them, but this not the preferred option.

mately 12 surgical technologists. These units have no junior personnel (E-3s) authorized; all are E-4s or E-5s. LANTFLT and PACFLT personnel are typically assigned to certain classes of ships. Only the larger ships (e.g., aircraft carriers) are authorized the most junior (i.e., one seaman E-3). Overall, 69 percent of all authorizations are for E-4s and below and 85 percent of these are authorized in BUMED. As with the other services, most surgical technologists are used in a definitive care setting.

Civilian Employment of Reservists

An issue for maintaining occupational qualification is whether reservists in the three services serving as military surgical technologists are similarly employed as civilians. Civilian employment data are available for approximately 50 percent of military surgical technologist reservists. Table 3.2 shows the distribution of reservist surgical technologists by their civilian occupation.

As shown in the table, about 31 percent of Army, 39 percent of Air Force, and 16 percent of Navy reservists are employed as surgical technologists in civilian life. Fifteen percent of Army reservists, 25 percent of Air Force, and 26 percent of Navy are employed in other health occupations.

Certification appears not to be an issue for employment. As discussed above, although hospitals generally want to hire certified surgical technologists, the vast majority will accept those without certification. What is striking is that proportionally fewer Navy personnel serve as civilian surgical technologists even though that service is the one most likely to have certification as a training outcome.

Table 3.2
Distribution of Surgical Technologist Reservists, by Civilian Occupation

	Surgical Technologist (%)	Other Health Occupation (%)	Nonhealth Occupation (%)	Total Number
Army	31.2	15.4	53.4	494
Air Force	38.8	25.0	36.3	80
Navy	16.1	25.8	58.1	124

Earnings

Civilian. The Bureau of Labor Statistics reported that the median annual earnings of surgical technologists were $36,080 in May 2006, with the middle 50 percent earning between $30,300 and $43,560. The lowest 10 percent earned less than $25,490, and the highest 10 percent earned more than $51,140.[10] About 40 percent of the certified surgical technologists surveyed in 2002 reported that they received extra compensation for being certified.[11]

Military. Average earnings for an active enlisted member at the grade of E-4 with four years of service and no dependents is $40,550 as shown in Table 3.3.[12] These numbers were calculated using an average for the continental United States (CONUS), a standard deduction, no state marginal tax rate, and no other income. The difference between the average military and civilian pay is largely attributable to the military allowances, which are tax-exempt. Having one or two dependents increases the allowances by between $2,500 and $2,800.

Table 3.3
Elements of Annual Military Compensation, E-4 with Four Years of Service

	Annual Compensation ($)
Basic pay	23,742.00
Basic allowance subsistence (BAS)	3,358.56
Basic allowance for housing (BAH)	10,932.00
Cash total	38,032.56
Tax advantage[a]	2,521.92
Regular military compensation	40,554.48

[a] This is calculated as the equivalent amount of tax that would be paid on the basic allowances, which are tax-exempt.

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10 Bureau of Labor Statistics (2008).

11 Montgomery and Marhefka (2002).

12 Office of the Secretary of Defense (n.d.).

Reservists at the pay grade of E-4–E-5 with four to six years of service earn between $5,000 and $6,000 annually, in addition to their civilian earnings.

On average, military personnel appear to earn more than their civilian counterparts, although the civilian averages fail to account for differences in training, certification, or level of responsibility. This may partly explain why many surgical technologist reservists do not work in this occupation in their civilian jobs. Better opportunities in or out of the health field may exist. The differences in compensation might make it possible for the military to attract trained personnel into the field and this will be explored further.

Looking to the Future

As part of developing the profile of the occupation as it currently exists, we emphasized the need to look to the future to understand how the occupation might change. This would have implications for developing a "future-looking" common standard of practice for the specialty that accounts for the new roles and responsibilities that the technician might be asked to play.

Civilian

The Bureau of Labor Statistics predicts that the percentage increase in jobs for surgical technologists will be larger than the overall increase in all occupations through the year 2014 and that job opportunities are expected to be good. Over the next 10 years, the surgical technologist workforce will increase by one-third. This is primarily because the number of surgical procedures is expected to rise as the population grows and ages. In addition, technological advances, such as fiber optics and laser technology, will permit an increasing number of new surgical procedures to be performed; this will increase the demand for surgical technologists to operate the equipment and to assist in these procedures. Moreover, the number of hospitals is expected to grow, and surgical technologists are expected to increasingly substitute for nurses because of shortages in that occupation. The surgical technolo-

gist workforce needs about 9,500 new entrants a year for replacement and 2,500 for growth. Hospitals likely will continue to be the primary employer of surgical technologists but there will be increasing demand from outpatient care centers and physician offices as well. However, the primary role of the surgical technologist as a key member of the operating room staff is not expected to change substantially, other than that they might be asked to take on some nursing duties, implying the need for more highly trained technicians.

Military

In general, the DoD has embarked on substituting civilian employees for military. Originally, the military had planned some civilianization of military surgical technologist billets in 2008 and beyond. However, the FY 2008 National Defense Authorization Act placed a moratorium on these conversions, so authorizations for military surgical technologists are expected to hold steady at current levels.

To understand whether and how work or work context might change for medical personnel, we conducted a systematic review of lessons learned regarding work context and employment of medical personnel in deployed settings from services' Web sites. We reviewed After Action Reports (AARs), lessons learned, and other notes and briefings that appeared to be related to the issues in which we were interested. We largely focused on lessons learned from Operation Iraqi Freedom and Operation Enduring Freedom. In total, we examined in detail 52 Army documents, 156 Air Force documents, and 115 Navy documents. We then read each of these selected items in its entirety and coded the lessons learned under three categories: (1) interoperability among services/joint forces, (2) doctrine, and (3) training. We did not find any lessons learned that appeared to suggest that work or the work context for surgical technologists was likely to change substantially in the near future.

With this as background, the next chapter delineates a common SOP for the surgical technologist specialty.

CHAPTER FOUR

Defining and Implementing a Common Standard of Practice for Surgical Technologists

This chapter illustrates the application of the methodology outlined in Chapter Two to the surgical technologist specialty. This includes Army Operating Room Specialist (68D), Air Force Surgical Service (4N131 and 4N151), Navy Surgical Technologist (HM 8483), and the civilian career field called surgical technologist, designated by the U.S. Department of Labor as O*NET 29-2055.00. A final section discusses program accreditation and individual professional certification.

Proficiency Level

Before developing the SOP, we selected the proficiency level for the specialty to which the SOP would be pegged. Given the civilian standard, we decided that individuals coming out of training (where training is some combination of classroom, clinical, and on-the-job training) should be qualified in the sense of being able to pass the CST examination successfully (regardless of whether they decide to apply for the credential). The NBSTSA defines a certified individual as follows:

> Certification as a surgical technologist or first assistant provides evidence to employers, other health care professionals, and the public that the certified individual has met the national standard for the knowledge that underlies surgical technologist and first assistant practice. Certified individuals demonstrate mastery of a broad range of knowledge of surgical procedures, aseptic tech-

> nique, and patient care by successfully completing either the surgical technologist or first assistant certifying examinations.[1]

Thus, in our terminology, being qualified means mastering the theoretical knowledge underpinning the surgical technologist specialty and being a productive, competent member of the surgical team. It does not mean being fully mission-effective or even perhaps fully deployable because that requires direct experience in units. However, a certified individual can carry out his or her duties with minimal supervision.

We now describe how we applied our methodology to the surgical technologist specialty: defining a common SOP for the specialty, validating the SOP with SMEs, and identifying and evaluating options for obtaining qualified surgical technologists.

Defining a Common Standard of Practice for Surgical Technologists

As described above, the SOP analysis creates a core capability set, where all military personnel with a specific title can be assumed to possess the core set of capabilities. We created the SOP by using documents from civilian and military sources describing the job. We designed the SOP to describe the work performed by job incumbents. Although training curricula define training rather than work and do not summarize work performed as accurately as occupational surveys do, curricula can be useful when more detailed formal occupational surveys are not available.

We compiled a list of activities performed by personnel in each service, selected from service source documents, and developed a list of broad categories into which these activities could be grouped. To illustrate each activity in greater detail, we used two sample tasks. These were simply meant to describe the activity, not to be exhaustive. We went through the list of activities checking to ensure that the full list

[1] National Board of Surgical Technology and Surgical Assisting (n.d.a).

allowed us to create a robust description of the career field that focused on the medical standard of practice and was not redundant.

We pared the list down in several ways. First, we removed several activities that appeared to be beyond the SOP for a surgical technologist. The goal of this SOP is to define the common set of competencies that any qualified surgical technologist in any military service can be expected to have. If a service expects its surgical technologists to perform other activities (for example, assisting with specialized types of surgery), then the activities are defined to be outside the common core set of competencies. This way, the SOP can serve as a guide for what curriculum should be combined at the METC. Thus, for example, we removed the following from the common SOP: perform in a chemical, biological, radiological, nuclear, and explosive (CBRNE) environment (Army); perform blood bank activities (Air Force); and perform as first assist (Navy).

Second, senior enlisted personnel perform a number of tasks that are not medically related; for example, career development and peer mentoring. Thus, perform quality assurance, perform patient education, perform professional development, and perform departmental management were all deleted from the SOP because these are tasks that would be performed by more experienced and senior personnel.

Third, we removed entries that appeared to be duplicative. It sometimes was difficult to decide if activities defined in different occupational analyses were the same or different. Thus, we erred on the side of caution, retaining activities in the list when it was uncertain whether the entries were similar, leaving it to the SMEs to vet the list.

All remaining activities that involved medically related work were retained. For example, the SOP can include such work as cleaning and maintaining medical equipment and processing medical records. This work is specific to the medical career field and should be included in the medical standard of practice.

Validating the Common Standard of Practice for Surgical Technologists

We created a format to display the SOP with activities and associated sample tasks. We organized the activities under three categories of work: patient activities, mixed patient and nonpatient activities, and nonpatient activities. These categories seemed to separate activities well with respect to direct patient care and medical activities surrounding direct patient care. For readability, within each category we attempted to order the activities in a rough approximation of the sequence in which they would be performed during a patient's time at the medical facility (for example, preoperative, intraoperative, and postoperative tasks). Analyses of different career fields may be better organized under different categories.

We shared the draft SOP with the SOP IPT members, who solicited comments from others they identified as SMEs. Each service provided very useful comments that we incorporated into a revised SOP. The first draft, which borrowed heavily from the civilian sector, did not resonate with the service SMEs. As a result of comments, we revised the draft SOP to reflect more military terminology. In addition, the SMEs suggested that specialized patient activities were beyond the scope of the common SOP and represented more advanced or specialized roles for surgical technologists and required additional training. These included perform dental clinic procedures; perform ear, nose, and throat (ENT) clinic procedures; perform orthopedic activities; perform urology activities; and perform ocular clinic procedures and were deleted from the final version.

Table 4.1 shows the final validated common SOP for surgical technologists, grouped under three headings. There appeared to be general consensus that the SOP was a good approximation of the work that a trained surgical technologist should know and be expected to do.

Table 4.2 shows how the RAND-defined SOP compares with work currently performed by personnel in the existing military and civilian occupations. There is a significant amount of overlap between the work performed by surgical technologists in all the services and that performed in the civilian sector. This would allow a greater degree

Table 4.1
Validated RAND Standard of Practice for Surgical Technologists

General Activities	Sample Task 1	Sample Task 2
	Patient Activities[a]	
Perform patient assessment	Assess medical conditions, diseases, and injuries	Perform physical assessment
Provide patient education	Counsel patient regarding treatment plan	Educate patient on health-related issues
Prepare the patient	Prepare a patient for movement to the operating room	Provide comfort and safety measures for the patient in the operating room
Provide patient transportation	Transfer patients from bed to bed	Prepare patients for evacuations
Perform nonsterile preoperative operating room activities	Don personal protective equipment	Open hand-held sterile supplies
Perform direct patient care	Administer oxygen therapy	Apply braces, splints, and other appliances
Perform duties of circulator	Prepare surgical skin	Prepare ancillary equipment
Perform emergency management	Assess medical emergencies	Perform as member of emergency medical teams
Administer medication	Administer intramuscular, subcutaneous, and intradermal injections	Administer local anesthesia
Perform perioperative duties	Perform surgical "time-out"	Position patients for surgery
Perform general clinical activities	Maintain basic cardiac life support	Review package integrity and expiration dates on all sterile instruments, supplies, or drugs
Perform sterile operating room activities	Adjust Mayo instrument tray stands while scrubbed	Adjust overhead operating lights while scrubbed
Perform nonsterile intraoperative operating room activities	Transfer patients to or from operating room tables	Identify breaks in sterile techniques

Table 4.1 (continued)

General Activities	Sample Task 1	Sample Task 2
Mixed Patient and Nonpatient Activities		
Control infections	Disinfect operating room and equipment	Manage infectious patients
Perform anesthesia support activities	Clean or sterilize airway equipment such as laryngeal mask airway	Change anesthesia machine rebreathing bags
Assist during and after a surgical procedure	Weigh sponges and calculate blood loss	Transport blood for transfusions
Perform operating room transportation	Pull case carts for daily surgical procedures	Transport routine specimens to laboratories
Nonpatient Activities		
Perform ancillary services	Collect laboratory samples	Collect surgical specimens
Perform aseptic techniques	Manage sterile field	Break down sterile fields
Manage equipment	Calibrate surgical and clinical equipment	Manage instrument and equipment tracking systems
Process hazardous materials	Process hazardous materials	Process biomedical waste
Perform patient administration	Help patients fill out medical forms	Interview patients to obtain medical history
Manage safety	Conduct safety inspections	Manage fire-safety guidelines
Manage supplies	Inventory medical supplies and equipment	Manage supply budget
Perform CSS activities	Wrap and label instrument sets for sterilization	Assemble instrument sets or equipment after cleaning
Perform maintenance and restocking activities	Maintain supply of fluids, such as plasma, saline, blood, and glucose, for use during operations	Maintain files and records of surgical procedures
Perform nonsterile postoperative operating room activities	Break down sterile fields while circulating	Stock operating room with sterile or nonsterile supplies

Table 4.1 (continued)

General Activities	Sample Task 1	Sample Task 2
Prepare the operating room	Arrange instruments and supplies on a sterile field	Obtain appropriate sterile and nonsterile items needed for surgical procedure
Establish field operating room and CMS	Prepare the operating room table for use	Prepare the suction machine for use
Prepare surgical team members	Perform the surgical hand and arm scrub	Put on sterile gown and gloves

[a] These involve some degree of medical contact, i.e., not just helping a patient fill out a form.

of combined training for these career fields at the METC. We also included, at the bottom of the table, activities outside the surgical technologist SOP that are currently being performed by personnel from one service but not those from other services. This comparison allows the METC to quickly understand what is common work for which personnel from different services can be trained together and what will be unique to some and for which service-specific training will need to be offered. For interested readers, we also provide the scope of practice outlined in the AST Core Curriculum in Appendix B.

Knowledge, Skills, and Abilities Important for the Surgical Technologist Occupation

We examined the O*NET detailed summaries of the KSAs that were ranked as important for the surgical technologist occupation. Where available, we also looked at the services' descriptions to see whether these seemed like a reasonable set of KSAs. The Navy had a detailed set of KSAs partially borrowed from the O*NET; their KSAs overlapped those in the O*NET to a significant degree.

Table 4.2
Comparison of RAND-Defined Standard of Practice with Those Defined by the Services and the Civilian Sector

General Activities	RAND SOP: Surgical Technologist	Army 68D: Operating Room Specialist	Air Force 4N151: Surgical Service Apprentice	Navy HM 8483: Surgical Technologist	Civilian O*NET 29-2055 00: Surgical Technologist
Patient Activities[a]					
Perform patient assessment	X	X	X	X	X
Provide patient education	X	X	X	X	X
Prepare the patient	X	X	X	X	X
Provide patient transportation	X	X	X	X	X
Perform nonsterile preoperative operating room activities	X	X	X	X	X
Perform direct patient care	X	X	X	X	X
Perform duties of circulator	X	X	X	X	X
Perform emergency management	X	X	X	X	X
Administer medication	X	X	X	X	X
Perform perioperative duties	X	X	X	X	X
Perform general clinical activities	X	X	X	X	X
Perform sterile operating room activities	X	X	X	X	X
Perform nonserile intraoperative operating room activities	X	X	X	X	X
Mixed Patient and Nonpatient Activities					
Control infections	X	X	X	X	X
Perform anesthesia support activities	X	X	X	X	X

Table 4.2 (continued)

General Activities	RAND SOP: Surgical Technologist	Army 68D: Operating Room Specialist	Air Force 4N151: Surgical Service Apprentice	Navy HM 8483: Surgical Technologist	Civilian O*NET 29-2055 00: Surgical Technologist
Assist during and after a surgical procedure	X	X	X	X	X
Perform operating room transportation	X	X	X	X	X
Nonpatient Activities					
Perform ancillary services	X	X	X	X	X
Perform aseptic techniques	X	X	X	X	X
Manage equipment	X	X	X	X	X
Process hazardous material	X	X	X	X	X
Perform patient administration	X	X	X	X	X
Manage safety	X	X	X	X	X
Manage supplies	X	X	X	X	X
Perform CSS activities	X	X	X	X	X
Perform maintenance and restocking activities	X	X	X	X	X
Perform nonsterile postoperative operating room activities	X	X	X	X	X
Prepare the operating room	X	X	X	X	X
Establish field operating room and CMS	X	X	X	X	X
Prepare surgical team members	X	X	X	X	X

Table 4.2 (continued)

General Activities	RAND SOP: Surgical Technologist	Army 68D: Operating Room Specialist	Air Force 4N151: Surgical Service Apprentice	Navy HM 8483: Surgical Technologist	Civilian O*NET 29-2055 00: Surgical Technologist
Specialized Patient Activities					
Perform dental clinic procedures				X	
Perform ENT clinic procedures				X	
Perform orthopedic activities				X	
Perform urology activities				X	
Perform ocular clinic procedures				X	
Work in CBRNE environment		X			
Perform blood bank activities			X		
Act as a first assistant				X	

NOTE: Because our study focused on graduates from initial skills training, we do not show Army or Air Force graduates as performing some of the specialized patient activities that they learn in more specialized and later training (for example, perform dental clinic procedures or perform ENT clinic procedures).

[a] These involve some degree of medical contact, i.e., not just helping a patient fill out a form.

Tables 4.3–4.5 show the KSAs listed in the O*NET. The O*NET also provides a standardized score of the "importance" of each item. Ratings on importance were collected on a 1–5 scale from respondents. The descriptor average ratings were standardized to a scale ranging from 0 to 100, using the following equation:

$$S = ((O - L) / (H - L)) \times 100$$

where S is the standardized score, O is the original rating score, L is the lowest possible score on the rating scale used, and H is the highest possible score on the rating scale used. For example, an original importance rating score of 2 is converted to a standardized score of 25 (25 = [[2 – 1] / [5 – 1]] × 100).[2] For purposes of the monograph, we selected all KSAs that had an importance rating of 50 percent or higher.

As is clear from the tables, the knowledge that surgical technologists need ranges from the sciences (medicine, chemistry, and biology) to the social sciences (psychology) along with an understanding of customers. Because surgical technologists interact closely with patients and other medical professionals as part of a team, skills such as active listening, active learning, critical thinking, and an ability to coordinate with others and communicate effectively head the list in terms of needed skills. Because they work closely with equipment, being able to select, monitor, and troubleshoot equipment is important. In terms of abilities, oral comprehension and expression and problem sensitivity are important, as are physical attributes such as good vision, manual dexterity, and physical strength and steadiness.

Identifying Options for Obtaining Qualified Surgical Technologists

As part of the analysis, we examined how to implement the common SOP, including outlining different ways to train or obtain qualified

2 O*NET (n.d.c).

Table 4.3
Knowledge Important for the Surgical Technologist Occupation: O*NET

O*NET Importance (%)	O*NET Knowledge	Knowledge Description
78	Medicine and dentistry	Knowledge of the information and techniques needed to diagnose and treat human injuries, diseases, and deformities. This includes symptoms, treatment alternatives, drug properties and interactions, and preventive health care measures.
76	Customer and personal service	Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.
67	English language	Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.
61	Education and training	Knowledge of the principles and methods for curriculum and training design, teaching and instruction for individuals and groups, and the measurement of training effects.
57	Chemistry	Knowledge of the chemical composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods.
53	Psychology	Knowledge of human behavior and performance; individual differences in ability, personality, and interests; learning and motivation; psychological research methods; and the assessment and treatment of behavioral and affective disorders.
51	Biology	Knowledge of plant and animal organisms, their tissues, cells, functions, interdependencies, and interactions with each other and the environment.

SOURCE: O*NET (n.d.b).

NOTE: The table lists only the knowledge area receiving an importance rating of 50 percent or higher on the standardized scale.

surgical technologists and accreditation and certification issues. The first option, on which this monograph focuses, given the mission of the METC, is in-house training. The participants in the HC ITO reviews put forward two variants of in-house training as the basis for consolidation. The first was termed the “currently achievable” option and was

Table 4.4
Skills Important for the Surgical Technologist Occupation: O*NET

O*NET Importance (%)	O*NET Skill	Skill Description
96	Active listening	Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
87	Active learning	Understanding the implications of new information for both current and future problem-solving and decisionmaking.
85	Critical thinking	Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.
81	Equipment selection	Determining the kind of tools and equipment needed to do a job.
80	Coordination	Adjusting actions in relation to others' actions.
79	Speaking	Talking to others to convey information effectively.
78	Learning strategies	Selecting and using training and instructional methods and procedures appropriate to the situation when learning or teaching new things.
78	Instructing	Teaching others how to do something.
71	Reading comprehension	Understanding written sentences and paragraphs in work-related documents.
71	Monitoring	Monitoring and assessing the performance of oneself, other individuals, or organizations to make improvements or take corrective action.
71	Troubleshooting	Determining causes of operating errors and deciding what to do about it.
66	Time management	Managing one's own time and the time of others.
65	Science	Using scientific rules and methods to solve problems.
65	Service orientation	Actively looking for ways to help people.

Table 4.4 (continued)

O*NET Importance (%)	O*NET Skill	Skill Description
65	Judgment and decisionmaking	Considering the relative costs and benefits of potential actions to choose the most appropriate one.
64	Operation monitoring	Watching gauges, dials, or other indicators to make sure a machine is working properly.
60	Quality control analysis	Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
58	Social perceptiveness	Being aware of others' reactions and understanding why they react as they do.
57	Mathematics	Using mathematics to solve problems.
56	Writing	Communicating effectively in writing as appropriate for the needs of the audience.
55	Complex problem-solving	Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
54	Operation and control	Controlling operations of equipment or systems.
51	Operations analysis	Analyzing needs and product requirements to create a design.

SOURCE: O*NET (n.d.b).

NOTE: The table lists only skills receiving an importance rating of 50 percent or higher on the standardized scale.

based on the current Air Force training regimen. However, it was clear from the reviews that the Army and Navy would continue their current practice and train for a longer period than put forward under this option. As a result, we focused on current practice rather than the strict currently achievable option. The second followed the Navy training regimen. Both program accreditation and individual professional certification are avowed goals of the METC. The Navy program is accredited and graduates are eligible to apply for the CST credential; hence this option was designated as "following best practices."

Table 4.5
Abilities Important for the Surgical Technologist Occupation: O*NET

O*NET Importance (%)	O*NET Ability	Ability Description
97	Oral comprehension	The ability to listen to and understand information and ideas presented through spoken words and sentences.
91	Problem sensitivity	The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing that there is a problem.
81	Oral expression	The ability to communicate information and ideas in speaking so others will understand.
81	Arm-hand steadiness	The ability to keep one's hand and arm steady while moving an arm or while holding one's arm and hand in one position.
78	Near vision	The ability to see details at close range (within a few feet of the observer).
78	Speech recognition	The ability to identify and understand the speech of another person.
75	Manual dexterity	The ability to quickly move one's hand, a hand together with an arm, or two hands to grasp, manipulate, or assemble objects.
75	Speech clarity	The ability to speak clearly so others can understand.
69	Inductive reasoning	The ability to combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).
66	Deductive reasoning	The ability to apply general rules to specific problems to produce answers that make sense.
66	Information ordering	The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, or mathematical operations).
66	Finger dexterity	The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects.
63	Selective attention	The ability to concentrate on a task over a period of time without being distracted.
63	Control precision	The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.

Table 4.5 (continued)

O*NET Importance (%)	O*NET Ability	Ability Description
63	Multilimb coordination	The ability to coordinate two or more limbs (for example, two arms, two legs, or one leg and one arm) while sitting, standing, or lying down. It does not involve performing the activities while the whole body is in motion.
60	Time-sharing	The ability to shift back and forth between two or more activities or sources of information (such as speech, sounds, touch, or other sources).
60	Trunk strength	The ability to use abdominal and lower back muscles to support part of the body repeatedly or continuously over time without experiencing fatigue.
56	Written comprehension	The ability to read and understand information and ideas presented in writing.
50	Written expression	The ability to communicate information and ideas in writing so others will understand.

SOURCE: O*NET (n.d.b).

NOTE: The table lists only abilities receiving an importance rating of 50 percent or higher on the standardized scale.

We examined other options as well, including lateral entry of trained civilian surgical technologists, outsourcing of training to civilian institutions, and civilianization of this occupation.

We describe each of these below in terms of the training (learning center, clinical, on-the-job, basic, and specialized military medicine) required to bring trainees to the "qualified" level.

Table 4.6 summarizes the training options.

In-House Training

As mentioned above and shown in the table, we examined two options under in-house training.

Current Practice Option. The Detailed Analysis Group proposed two options, one of which was labeled as the "currently achievable" option. Under this, service members will go to basic training with their own service for approximately 8–10 weeks. Following basic training,

Table 4.6
Options for Obtaining Qualified Surgical Technologists

Option	Service Basic Training (weeks)	Consolidated and Service-Unique Training (Phase I)[a] (hours)	Other Training
In-house training			
Current practice			
Air Force	8	368[b]	240 hours Phase II[b] + OJT
Army	8	408	400 hours Phase II
Navy	8	456	600 hours Phase II
Navy with HM 0000 course	8	456	600 hours Phase II; additional 14 weeks of HM 0000 course before surgical technologist training
Following best practices	8	456	600 hours Phase II
Lateral entry of trained surgical technologists	8		2 weeks orientation
Civilian-provided training	8		~50 weeks civilian training + 2 weeks orientation
Conversion to civilian positions	N/A	N/A	N/A

[a] Phase I training hours shown include both consolidated and service-unique hours as described in the RRA minutes. For example, of the 368 Phase I hours in the current practice option, 226 hours are consolidated hours across the three services, 20 hours are consolidated between the Army and the Air Force only, and the remaining hours are service-unique hours. Similarly, of the 456 Phase I hours in the following best practices option, 390 hours are consolidated across the three services; an additional eight hours are consolidated between the Army and the Air Force; and the remaining hours are service-unique hours.

[b] As of November 26, 2007, the Phase I course increased by 16.5 hours and the Phase II course increased by 16 hours (Air Force comments on initial draft report, July 2008, unpublished). The information was received only recently and thus the analyses reported here use the numbers shown in the table.

service members who will pursue the surgical technologist occupation will go to METC for 368 hours, of which 226 hours will be tri-service consolidated training, an additional 20 hours will be consoli-

dated Army and Air Force training, and the remaining 122 hours will be service-unique training. This will be followed by 240 hours of consolidated Phase II (clinical) training at a number of sites, preferably close to San Antonio. Service members will then receive on-the-job training in actual units for several months to bring them to the qualified level of proficiency. Because this will not be an accredited course, service members will not be able to sit for the CST exam. As mentioned above, the AST core curriculum, although it does not direct the number of hours for didactic and clinical training, does list the number and types of clinical cases in which graduates should have participated, and there is general consensus among the accrediting bodies that this would require a minimum of 500 hours of clinical training. Thus, it is unlikely that the currently achievable option would meet accreditation standards.

The current Navy and the Army training regimens are longer than in the currently achievable option, and it seems likely that they will continue to train to their current levels in both Phase I and Phase II by providing additional service-unique hours. Thus, in evaluating the effect of the training option on costs, we used the current practice as the baseline and then examined how costs would change as the services all adopted the following best practices option. For the Navy, we considered two options—with and without the additional 14-week HM 0000 course, which all their medical enlisted personnel attend.

Keep in mind that because we are not evaluating the currently achievable option as outlined by the HC ITO review groups, we label the first option as the "current practice" option.

Following Best Practices Option. Service members will go to basic training with their own service for approximately 8–10 weeks. Following basic training, service members who will pursue the surgical technologist occupation will go to the METC for 456 Phase I training hours, of which 390 hours will be tri-service consolidated training, an additional eight hours will be consolidated Army and Air Force training, and the remaining hours will be additional service-unique hours. Service members will then attend 600 hours of consolidated Phase II (clinical) training at a variety of sites, preferably close to San Antonio. Service members completing Phase I and Phase II training will be

qualified surgical technologists and will be eligible to sit for the CST exam.

It is important to note that we do not make any assumptions regarding coursework prerequisites for initial entrants. The Navy currently sends all of its medical enlisted personnel to the 14-week HM 0000 school; thus, its surgical technologist trainees enter the course with some level of medical and clinical knowledge. However, we do not assume that this is necessary; in fact, we cost out the savings to the Navy from not requiring the HM 0000 course.

Lateral Entry of Trained Civilians

Each service could recruit trained civilian surgical technologists and bring them into the military as lateral entrants. These recruits could be certified technologists or not, depending on whether the services value certification as an important credential. On entering the military, these individuals will need to participate in service-specific basic training for eight weeks. Following basic training, service members will also attend a one-week general orientation to military medicine and will attend a one-week military-specific surgical technologist refresher training course.

Civilian-Provided Training

Service members will go to basic training with their own service for approximately eight weeks. Following basic training, service members pursuing the surgical technologist occupation will be sent to various civilian programs across the United States to attend an approximately 50-week course in surgical technology (the median length of civilian programs). After completion of the 50-week course, which includes didactic and clinical training, service members will return to the military and will attend a one-week general orientation to military medicine, and service members will also attend a one-week military-specific surgical technologist refresher training course. It is possible that the military could ask the civilian institutions to tailor and shorten the course for their students but, in the cost analysis, we assume the length of time given above.

Conversion to Civilian Positions

Although we considered a military-civilian conversion of the surgical technologist billet, the National Defense Authorization Act of 2008 placed a statutory moratorium on such conversions from October 1, 2007, through September 30, 2012, making this option moot for the immediate future. However, we include it as an option that the services may wish to consider in the future.

We now turn to issues relating to program accreditation and individual certification. As we mentioned, regardless of which option is considered, decisions need to be made about the value-added of program accreditation and individual certification, given the additional costs. For in-house training, both of these will increase training costs in terms of meeting accreditation requirements as well as costs for the credential; for lateral entry, hiring graduates of accredited programs or certified surgical technologists may require a small bonus to attract such individuals into the military; if training is outsourced, tuition costs may well be higher for programs that offer a route to certification.

Accreditation of Programs

As mentioned above, there are two accrediting bodies relevant to the field of surgical technology: (a) CAAHEP and (b) ABHES. The former accredits programs and currently has 450 accredited programs. The latter offers both institutional and programmatic accreditation and currently lists 25 institutions in 14 states and 17 programs in six states as accredited in surgical technology. Both bodies require that programs seeking accreditation follow the curriculum set forth by the Association of Surgical Technologists, the professional association of surgical technologists.

The Commission on Institutions of Higher Education (CIHE) offers an excellent primer on the role and value of institutional and specialized (program) accreditation (see Appendix D). The Accreditation Review Committee on Education in Surgical Technology—the specialized CAAHEP committee that oversees accreditation of pro-

grams in surgical technology—provides a brief summary of the value of accreditation[3]:

> Accreditation is a system for recognizing educational institutions and professional programs for a level of performance, integrity, and quality that entitles them to the confidence of the educational community and the public they serve. In the United States, this recognition is extended primarily through non-governmental, voluntary institutional or professional associations. Accreditation performs a number of important functions, including the encouragement of efforts toward maximum educational effectiveness. The accreditation process requires institutions and programs to examine their goals, activities, and achievements; to consider the expert criticism and suggestions of a visiting team; and to determine internal procedures for action on recommendations from the accrediting body. While accreditation is basically a private, voluntary process, accrediting decisions are used as a consideration in many formal actions by governmental funding agencies, scholarship commissions, foundations, employers, and potential students.

We interviewed several heads of professional associations and certification and accreditation organizations. The interviews focused on the value of accreditation to the military as the METC sets up a consolidated program, as well as the value-added of individual certification. Although we recognize that some of the views are likely to be biased in favor of both program accreditation and individual certification, we believe that the responses offer some useful insights.

Our respondents were uniformly in favor of accreditation. They believed that accreditation acted as an external validator of the program, ensuring both the quality of the program and the quality of the practitioner graduating from that program. CAAHEP was described by one interviewee as the "gold standard" because of its long history with the surgical technology program (it has been accrediting programs in this field since 1972), its commitment to research and study in this area,

3 Accreditation Review Committee on Education in Surgical Technology (n.d.a).

and its access to and involvement with communities of interest. The ARC-ST makes sure that its standards are current and any changes are vetted through expert panels and committees. It stays closely involved with both the NBSTSA and the AST. Changes to standards need to be approved by the sponsors themselves, including these organizations and the American College of Surgeons (ACS). Asked about the difficulty that the military might face in obtaining accreditation because its instructors are generally not certified surgical technologists, ARC-ST pointed to its alternative delivery program as a way for practicing and experienced surgical technologists to get the certification.

It should be mentioned that ABHES also bases its accreditation on the AST core curriculum and, thus, there is likely a strong similarity among accredited programs. One advantage of ABHES accreditation is that it could provide METC institutional as well as programmatic accreditation. Both CAAHEP and ABHES expressed a strong desire to be helpful to the military. Overall, the interviewees recommended that the military follow the core curriculum and seek program accreditation or that the METC seek institutional accreditation.

As an informal check on what we were told about the value of accreditation, we conducted a quick survey of vacancy postings for surgical technologists in hospitals across the nation to understand the requirements for these positions. We found that many employers wanted graduates of accredited, "recognized," or "approved" programs with a very few specifying that the program should be CAAHEP-accredited.

Professional Certification

Technologists may obtain voluntary professional certification in two ways. NBSTSA awards the CST designation to those who graduate from an accredited program (either CAAHEP or ABHES) and pass the CST national certification examination. Certification also may be obtained from the National Center for Competency Testing, which awards the Tech in Surgery-Certified designation to those who pass the NCCT national examination for surgical technologists.

As mentioned above, certification offers employers assurance that the individual has met the national standard for practicing as a surgical technologist. In addition:

> Because certification is voluntary, the choice to become certified demonstrates individual pride in the profession, the desire to be recognized for mastery of the principles of science and patient care unique to surgical technology, and an ongoing commitment to quality patient care. Certification can be a means for upward mobility, a condition for employment, a route to higher pay, and a source of recognition nationwide.[4]

Despite this, the percentage of surgical technologists who are certified is fairly small. For example, the Bureau of Labor Statistics reported that about 84,000 surgical technologists were employed in the civilian sector. NBSTSA and AST reported that there are currently 24,000 CSTs actively employed in the field, who accounted for 31 percent of all employed surgical technologists. Of these, about 250–500 certificate holders were certified before 1977 and were granted certification for life through board action. One interviewee expressed skepticism that there were indeed 84,000 surgical technologists in the nation, suspecting that some respondents who identified themselves as surgical technologists may be working not in this field but in a related one. Thus, the percentage of certified surgical technologists may be overstated.

One important point to consider is that only three states currently define scope of practice for certified versus uncertified surgical technologists or have licensing restrictions preventing those who are not certified from practicing their trade. AST has been working with states to pass model laws requiring that surgical technologists be certified before being able to work. For example, to work as a surgical technologist in South Carolina (whose law was described as a model law by AST), one has to be a graduate of a CAAHEP-accredited program and have the CST credential. In Tennessee, one needs to be a graduate of a

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4 National Board of Surgical Technology and Surgical Assisting (n.d.a).

CAAHEP-accredited program or have the CST credential. In 10 other states, such legislation is under consideration.

Interviewees pointed out that the credential provides the employer with reassurance about an individual's training and qualifications, provides greater impetus for reservists to work in their field, and provides access to higher-paying jobs with greater responsibility through a career ladder. Interviewees mentioned that the career ladders for surgical technologists were becoming more common and were being used more frequently ("a dramatic increase" as one respondent remarked) but that these ladders were available only to those who graduated from an accredited program and were certified.

The evidence seems to suggest that lack of certification is not a bar to employment. Individuals can and do work as surgical technologists without being certified. Our informal survey of job openings in hospitals showed that certification was either not mentioned or was mentioned infrequently as something "preferred." The CST credential was mentioned specifically—we did not see any reference to the NCCT credential—although, sometimes, the job open notice simply stated that "certification" was preferred. A few states require certification and the CST credential is mentioned explicitly. Employers may choose to use certified surgical technologists differently but our interviewees did not believe that there were major differences in the standards of practice for certified versus uncertified surgical technologists. Having an accredited program would allow individuals to sit for the certification examination. It is difficult to judge the value-added of the certification credential to the ability of individuals to perform as trained surgical technologists.

The next chapter discusses the in-house training options and evaluates them against the criteria of cost and likely effects on service culture, recruitment, and retention.

CHAPTER FIVE

Producing a Qualified Surgical Technologist: In-House Training

This chapter evaluates the in-house training options against the criteria of cost, service culture, recruitment, and retention. As shown in Table 4.6, we evaluate the effect of moving the Air Force and the Army from their current practice to the following best practices option. The Air Force's current training regimen consists of 368 hours of Phase I training and 240 hours of Phase II training;[1] the Army's current practice is somewhat longer—408 hours of Phase I training and 400 hours of Phase II training. For both, the following best practices option would increase Phase I training to 456 hours and Phase II training to 600 hours. For the Navy, this represents the current practice. The amount of consolidated tri-service training and service-unique training varies across the two options. We assume for our evaluation that students complete both phases of the training sequentially, before being sent out to units. The first option requires some level of OJT to bring the Air Force and Army surgical technologists to the "qualified" level expected of individuals graduating from an accredited program with eligibility for the certification credential. Because the Navy program is accredited, we assume that Navy surgical technologists are qualified when they graduate. All service members, regardless of service, will require operational experience to become fully effective. We discuss this further in the next section.

[1] As noted in Chapter Three, as of November 2007, Air Force Phase I training increased by 16.5 hours and Phase II course increased by 16 hours. Also as noted, this information was received only recently, after the analyses for this monograph had been completed.

Given that the Navy sends all its medical enlisted personnel to the 14-week HM 0000 school, Navy training is considerably longer than that shown for the surgical technologist program. We assume that, if consolidated, the tri-service program would total 1,056 hours and the Navy could choose to continue its current practice of requiring the HM 0000 school up front. We evaluated the costs of the following best practices option in two ways for the Navy—with and without the HM 0000 course—so it has the information necessary to weigh the additional costs of such training against the flexibility of having all of its personnel trained as basic corpsmen.

The in-house training options accrue costs in different ways. The current practice option has lower upfront learning center costs because fewer training hours are required but this option will accrue larger OJT costs that are more difficult to measure directly and are incurred in operational organizations. The following best practices option has greater upfront costs that are directly measurable at the learning center.

The method we used to analyze the cost trade-off between longer and shorter initial training (both Phase I and Phase II) at the learning center is to measure the effect on total effectiveness of service members over their lifetime. This requires that we estimate the proficiency of individuals at the time of graduation from the learning center and throughout their career and to link these proficiency estimates with data on retention rates to estimate the total force effectiveness in terms of fully effective man-years. We also use data on costs to estimate total training costs. We estimate proficiency through surveys of experienced surgical technologists and supervisors and use cost data from a variety of sources, as discussed below.

Our methodology builds on and extends previous work in this field. Appendix E reviews previous studies that have used similar methodology.[2]

For this analysis, we focus only on service members in the active duty component, because it is difficult to estimate the effectiveness of reservists over their career or the percentage of time they actually spend

2 Appendix E is excerpted from Manacapilli et al. (2007).

on surgical technologist duties as opposed to more general military work during their two-week annual training and their monthly drills.

Estimating Effectiveness Under Different In-House Training Options

This section describes how we estimated the effectiveness of service members under the different in-house training options. Data were collected from supervisors in the services using a survey instrument and then modeled using different functional forms to estimate proficiency at different points in a service member's career.

Table 5.1 presents the total training time in years for the different options being evaluated, including eight weeks of basic training. Because individuals are assumed to be at the learning center during this entire time period, we assign them a zero effectiveness level for the length of time they are in training. The assumption is that longer training allows individuals to become more proficient, and this means that they are more productive when they go to operational units than others trained for shorter periods of time. Over time, as individuals gain more experience, they all attain 100 percent effectiveness, i.e., they are fully mission-effective, although more highly trained individuals may approach this level at an earlier point in their career. Thus, the trade-off is between paying for unproductive time up front at the learning center and paying for less-effective individuals at the unit in the early years. The effectiveness calculations for the entire workforce also factor in the length of time individuals stay in the service because that will dictate the amount of productive work the service recoups from a trained individual.

Survey Instrument

Our primary tool for gathering expert opinion was a 12-question data-collection tool, which spanned a number of topics related to job productivity at different time periods and at different events (such as the end of training) as the individual progressed toward becoming a fully mission-effective worker (see Appendix C). The tool was designed to be

Table 5.1
In-House Training Options Used in the Cost Analysis

Training Option	Basic Training (weeks)	Surgical Technologist Training (weeks)[a]	HM OOOO Course	Total Time in Training (weeks)	Total Time in Training (years)[a]
Air Force					
Current practice	8	15.2	N.A.	23.2	0.45
Following best practices	8	26.4	N.A.	34.4	0.66
Army					
Current practice	8	20.2	N.A.	28.2	0.54
Following best practices	8	26.4	N.A.	34.4	0.66
Navy					
Following best practices + HM 0000 course	8	26.4	14	48.4	0.93
Following best practices	8	26.4	N.A.	34.4	0.66

[a] We estimate that during the didactic and clinical phases, individuals train for 40 hours per week. Thus, the Air Force current practice option equals 15.2 weeks (368 + 240 hours = 608/40); the Army current practice option equals 20.2 weeks (408 + 400 hours = 808/40). The Navy following best practices option equals 26.4 weeks (456 + 600 = 1,056/40).

completed in less than 15 minutes and was tailored to each service, so the nomenclature was service-specific; however, the intent and wording of the questions were otherwise identical across the three services.

The notion of a fully effective worker establishes a key benchmark for the entire data-collection tool and our analysis. Essentially, referring to previous work, we define a fully effective individual as one that a supervisor would "go to" for most important unit-related tasks. The fully effective worker represents 100 percent effectiveness on the productivity curves we create. It is not likely that an individual trained to the "qualified" level will be fully mission-effective. Further experience and OJT will be needed to establish the service member as the "go to" person. Using SME recommendations and previous research,

we developed the definition shown above and repeat it in Table 5.2 for convenience.[3]

We ask supervisors to rate how effective individuals are at various points of time and at key phases, given this definition. Specifically, we ask for the average rank and years of service (YOS) needed before a person becomes fully mission-effective. The intent is to not only capture the mean but to understand the variance among SMEs' opinions of the service members they have observed. In other survey items, we ask supervisors to define progress toward becoming fully mission-effective at specific year points (years 1, 3, 4, 5, and 7) and at specific events as appropriate (for example, at the end of Phase II training).

We recognize that there is a difference between a fully effective worker and a fully effective leader/manager. Most of the productive work of a unit is done at the lower grades. Leadership and management are, in a sense, force multipliers. If we had included leadership and management, the effectiveness of the individual would have dipped for

Table 5.2
Defining a Fully Mission-Effective Worker

In many career fields, the goal of technical training is to produce a "mission-ready" airman. In addition to technical training skills, a fully mission-effective worker is one who:
you would probably want to send on short notice temporary duty to "base X" to resolve a nebulous, yet difficult, problem with little to no supervision
you can count on to effectively handle most occupation-related situations that arise
knows how to operate effectively in a normal, exercise, or deployed environment
can train junior members effectively and properly document their training
knows how different organizations in the unit work, those organizations' responsibilities, and how those organizations interact with one another to meet mission requirements
can organize or direct others to complete work
is called your "go-to-person"

SOURCES: Adapted from Oliver et al. (2002); Manacapilli et al. (2007), Figure 3.1.

[3] Oliver et al. (2002); Manacapilli et al. (2007).

the individual as he learns these new skills. Eventually, effectiveness would increase as the individual became a fully mission-effective leader/manager. We did not want changes in effectiveness that result from grade structure (at the higher grades) to obscure the trade-offs we were examining between longer learning center training and OJT at the lower grades. We assumed that a service member's effectiveness would increase from the time of graduation from the training program until the time the service member reached 100 percent effectiveness.

Data

We were given a point of contact in each service and we requested a minimum of 30 responses from experienced surgical technologists and supervisors from each service. We received responses from 71 surgical technicians in the services.[4] Table 5.3 shows the distribution of respondents by service.

We did not receive enough responses from the Army to develop a productivity/effectiveness curve. As a result, we assumed that the Army effectiveness levels would be somewhere in between those of the Air Force and the Navy, given that the Army current practice regimen is longer than that of the Air Force but shorter than that of the Navy. This assumption must be kept in mind when examining our results.

Table 5.3
Distribution of Respondents, by Service

Service	Number of Responses
Air Force	30
Navy	29
Army	12

[4] We received a few responses from individuals who were below the pay grade of E-5. We used E-4s if the personnel had more than four years of service.

Response Statistics and Resolving Inconsistencies in the Responses

The survey asked respondents to rate the productivity of the average service member on a scale of 0 to 100 percent of full mission-effectiveness at the end of Phase I and Phase II training and at two, three, four, and five years of experience. The survey instrument used with the Air Force also asked respondents to estimate productivity at the receipt of the journeyman (5-skill) status, which, in the case of the surgical technologist, corresponds to two years. Because of the distinction between events and end-year points, there was some inconsistency in the Air Force responses, which were resolved by assuming that effectiveness would increase over time until the point of 100 percent effectiveness, albeit at different rates (this is discussed further below). Army and Navy respondents were asked about end-of-training and end-of-year productivity so end-points were arrayed in a sequential manner. As mentioned above, we do not use Army data for the analyses presented here because of small sample size.

Tables 5.4–5.5 show the variation in the Air Force and Navy responses regarding the effectiveness of the average airman and sailor, respectively, at the selected end-points. On average, Air Force respondents had served for about 15 years in the military, although the standard deviation was five years. Their responses indicated that an individual reached full mission effectiveness at an average grade of E-4 and by the end of 4.3 years of service. On average, the estimated productivity at the end of training, year 3, and year 4, was 32, 64, and 81 percent, respectively.

The Navy respondents, on average, had served about five years and, surprisingly, also estimated that an individual would reach full effectiveness at around 4.3 years of service and at a grade of E-4. The estimated effectiveness at the end of Phase II training, year 2, year 3, and year 4 was 41, 72, 83, and 92 percent, respectively.

The mean and median tend to be close to each other, suggesting that the data are not skewed. However, the standard deviations and the interquartile ranges[5] show a great deal of variability in the responses.

[5] The interquartile range is the difference between the values at the 75th and 25th percentiles and shows the spread of the middle 50 percent of the distribution.

Table 5.4
Summary Measures of Survey Data from Air Force Respondents: AFSC 4N1X1

Category	Measure	Mean	Std. Dev.	Interquartile Range
	Years of Service			
Respondent experience	YOS	15.0	4.9	
Full productivity	Average grade	E-4		
	Average YOS	4.3	1.4	1.8
	Percentage			
Productivity at different points	At end of Phase I	19.8	12.0	15
	At end of Phase II	32.4	15.7	25
	At end of year 2[a]	52.5[a]	21.9	22
	At end of year 3	63.9	20.0	25
	At end of year 4	80.8	18.4	30
	At end of year 5	93.2	11.6	13

[a] This is at receipt of journeyman status. Because of inconsistent responses, this was estimated from the other data points using simple interpolation between the two adjacent data points.

We believe that these results occur because of both the lack of definitive standards and the natural variance of experience among the respondents. It is also possible that some respondents did not understand the questions, although few respondents indicated any difficulty in the remarks section of the survey.

The second inconsistency we noticed was that Navy respondents estimated that individuals would take the same length of time as the Air Force graduates to become fully mission-effective, despite their much longer training period. We had expected that Navy graduates would reach full effectiveness much earlier. However, Navy SMEs noted that they expected their surgical technologists to work at a more advanced level—at the level of a surgical first assistant. Thus, it is likely that Navy respondents are rating their trainees against a higher standard than is the case with the Air Force respondents. Thus, we may not be

Table 5.5
Summary Measures of Survey Data from Navy Respondents: NEC HM 8483

Category	Measure	Mean	Std. Dev.	Interquartile Range
	Years of Service			
Respondent experience	YOS	5	3.9	
Full productivity	Average grade	E-4		
	Average YOS	4.3	1.5	1.75
	Percentage			
Productivity at different points	At end of Phase I	25.9	21.2	20
	At end of Phase II	41.0	19.8	20
	At end of year 2	72.1	17.4	22.5
	At end of year 3	83.4	14.3	23
	At end of year 4	92.0	9.8	20
	At end of year 5	97.2	5.4	2.5

comparing against the same yardstick and it may be that Navy graduates are more productive than the data would indicate, judged against the surgical technologist standard. We return to this point below.

Deriving Effectiveness Curves

Because the data were so variable, we fit both a traditional nonlinear function to the data as well as a piecewise linear function that was allowed to vary to provide sensitivity estimates. Because the results were very similar in terms of effective workforce calculations and costs, we show the results of the piecewise linear function here. Appendix F discusses the estimated nonlinear function.

Table 5.6 shows the estimated mean proficiency at selected endpoints under the current practice option. Looking first at the Air Force, estimated proficiency is 32 percent at the end of training, which encompasses 0.45 of a year, and 64 percent at the end of year 3. We used simple linear interpolations between points to fill in the rest of the data assuming a piecewise linear function. Navy training occupies

Table 5.6
Estimated Effectiveness Levels at Selected End-Points, by Service: Current Practice Option

Year	Army[a] (%)	Air Force (%)	Navy with HM 0000 (%)
0.45	N.A.	32.4	N.A.
0.62	36.0	34.5	N.A.
0.66	36.8	35.1	41.9
0.93	41.9	38.6	46.5
2.00	62.0	52.5	71.5
3.00	74.0	63.9	84.8
4.00	88.0	80.8	93.5
5.00	100.0	100.0	100.0
6.00	100.0	100.0	100.0

[a] Estimated from Air Force and Navy data.

0.93 of a year if we include both the HM 0000 course and the surgical technologist training. If we take the data at face value, we can assign 42 percent productivity at the end of 0.66 years, the normal length of time of surgical technologist training. Thus, at the end of 0.93 years, they are assumed to be somewhat more proficient (47 percent), judging by simple linear interpolation.

For Army graduates, we simply estimated their proficiency as the midpoint of the Navy and Air Force productivity estimates. The Army trains for about 0.62 of a year and we estimate beginning efficiency at 36 percent. The rest of the Army curve was estimated in a similar fashion.

However, it must be noted that the effectiveness level shown at each of these end-points is the level reached at the *end* of that period. Thus, over the particular time segments, we need to estimate an *average* effectiveness to account for the fact that individuals grow in proficiency over that time period. We simply averaged over the estimated proficiency at the beginning and end of the time period to represent an

average proficiency during that period. Thus, for each service, we show estimated annual effectiveness under two options: current practice and following best practices. Note that for the Navy, the current practice option includes HM 0000 but the following best practices option does not. However, the only difference is the productivity during year 1. Estimated proficiency is the same for all three services under the following best practices option. These annual proficiency estimates are shown in Table 5.7.

An important caveat that must be mentioned here is the differential annual proficiency gains implied by the piecewise linear function (Table 5.8). Looking at the current practice option first, the Army and Navy show that the annual gain in proficiency declines consistently from years 2 through 6. This reflects intuition and academic literature indicating that the rate of learning decreases over time. The exception for the Army and Navy is in the first year, when the increase in effectiveness appears to be small. However, the small increase is simply because service members spend very little time at an operational unit in the first year, allowing little opportunity to increase their effectiveness; the rate

Table 5.7
Estimated Annual Effectiveness Levels During Years 1–6, by Service and Option

	Army (%)		Air Force (%)		Navy (%)	
Years	Current Practice[a]	Following Best Practices	Current Practice	Following Best Practices	Current Practice	Following Best Practices
1	39.6	44.2	36.0	44.2	47.5	44.2
2	52.6	59.8	46.0	59.8	59.8	59.8
3	68.0	78.2	58.2	78.2	78.2	78.2
4	81.0	89.2	72.4	89.2	89.2	89.2
5	94.0	96.8	90.5	96.8	96.8	96.8
6[b]	100.0	100.0	100.0	100.0	100.0	100.0

[a] Estimated from Air Force and Navy data.

[b] We assume 100 percent effectiveness over the remainder of the service member's career.

Table 5.8
Estimated Annual Percentage Gains in Productivity During Years 1–6, by Service and Option

	Army		Air Force		Navy	
Years	Current Practice[a]	Following Best Practices	Current Practice	Following Best Practices	Current Practice	Following Best Practices
1–2	13.0	15.6	10.0	15.6	12.3	15.6
2–3	15.4	18.4	12.2	18.4	18.4	18.4
3–4	13.0	11.0	14.2	11.0	11.0	11.0
4–5	13.0	7.6	18.1	7.6	7.6	7.6
5–6[b]	6.0	3.2	9.5	3.2	3.2	3.2

[a] Estimated from Air Force and Navy data.

[b] We assume 100 percent effectiveness over the remainder of the service member's career.

of learning is still high. For the Air Force, however, our data predict increasing annual proficiency gains until the fifth year, which seems counter to the more traditional diminishing returns to learning that one would expect.

Estimating Total Effective Man-Years per Service Member, Steady State

We turn to a steady state calculation to assess the expected productivity that a training option may yield when implemented by a service. We are considering that the services may move to the following best practices option. Our survey results indicate that this option will yield service members with higher initial effectiveness when they arrive at the unit, but productivity will have been lost at the unit because of the additional time that service members spend in skills training. We calculate the total increase or decrease in effectiveness across the career field for each military service, once the new training option has been adopted, and make any necessary adjustments to the number of accessions entering the career field.

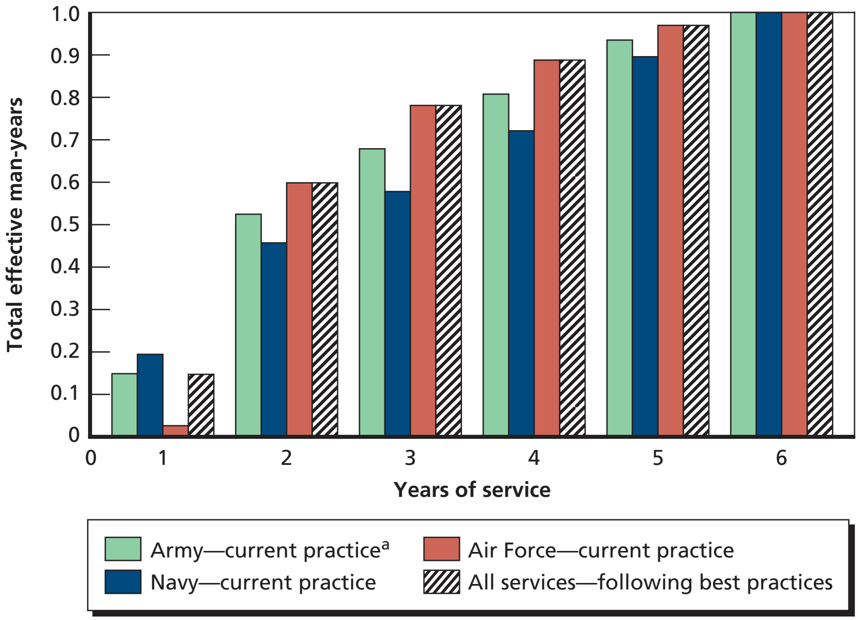
To simplify the analysis, we calculate the steady state effect on productivity—the expected productivity across an entire career field once the new training policy has affected all enlisted service members. We acknowledge that the true steady state will not be reached for at least 30 years, or until all enlisted service members are products of the proposed training option. However, we propose that the system costs and benefits will be nearly approached after roughly eight years, when cumulative retention rates drop below 20 percent. At this point, the vast majority of enlisted service members will have received the proposed training option, and the steady state calculation will be a reasonable approximation of annual costs and benefits.

In calculating the total effective man-years produced by service members in each year of service, two key pieces of data are needed. The first is the estimated effectiveness over each year of the career. These are reported in Table 5.7.

The second is the time spent in training at the learning center, which, by definition, is set at zero productivity, because the individual is not contributing to the operational unit. We do not account for advanced training later in the career—the percentages in training are fairly small and the results do not substantially change if we allow for that. As a result, except for the first year, a service member is spending all his or her time at the unit. Thus, during the first year, under the current practice option, Army, Air Force, and Navy service members spend 0.38, 0.55, and 0.07 of a year, respectively, at the unit. Under the following best practices option, each will spend 0.33 of the first year at the unit.

With these two pieces of information, we can multiply over service training option and YOS to find the expected steady state man-years of effectiveness produced by a service member in each YOS; these are displayed in Figure 5.1. We calculate the expected effective man-years produced by a service member in a YOS, in the steady state. Thus, for example, under the current practice option, an Army service member who spends 0.38 of the first year at the unit at an average productivity level of 0.396 (assuming that 100 percent productivity = one fully effective man-year) provides an equivalent of (0.38×0.396) or 0.15 of

Figure 5.1
Total Effective Man-Years per Service Member in Steady State, by Service, Training Option, Years of Service, and Annual Effectiveness



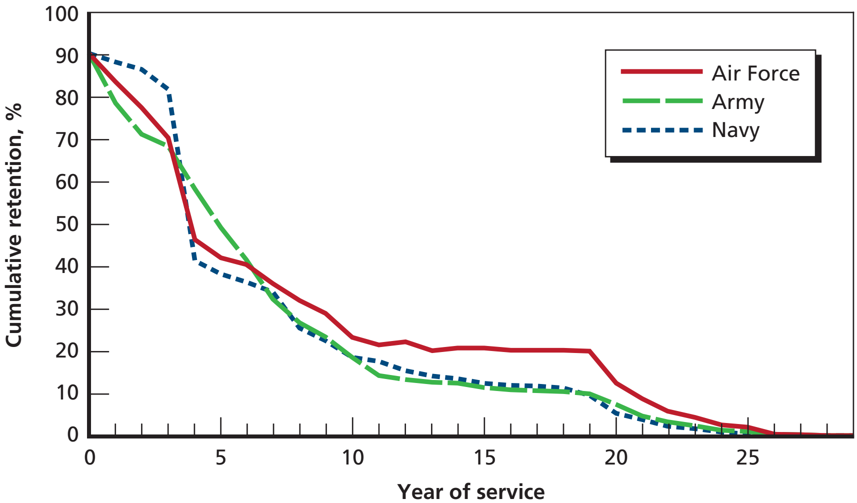
[a]Estimated from Air Force and Navy data.
RAND *MG774-5.1*

a fully effective man-year. We assume 1.00 man-years effective productivity beyond six years of service.

Estimating the Total Effectiveness of a Given Workforce

A third key piece of data is the number of service members in each YOS. We calculate this by using the cumulative retention profile for the surgical technologist specialty and the total number of service members in a career field. We obtained data from each service (reenlistment data, attrition data, and term of enlistment data) for enlisted personnel in the specialty. Figure 5.2 depicts the cumulative retention rates for each service. After gaining seniority, many senior surgical technologists change specialty codes and work as administrators or leaders rather than in the surgical technologist specialty. Thus, the curve shows actual retention

Figure 5.2
Cumulative Retention Rates Among Services for the 4N1X1, 68D, and HM 8483 Career Fields



RAND *MG774-5.2*

data for surgical technologists in each service over the first 13–15 years and estimated retention rates beyond that point. For our purposes, the early years are the most important for the cost calculations.

We use cumulative retention rates to calculate the population in each year of service. We then calculate the total expected effective man-years produced in the steady state, by summing across YOS.

$$T = \sum_{i=1}^{30} P_i * W_i * N_i$$

where

T = total expected effective man-years in the steady state
P_i = population in year of service i
W_i = average proficiency of a person in year of service i
N_i = proportion of year spent at an operational unit for year of service i
i = indexes years of service from 1 to 30

Thus, if 100 service members in YOS 1 spend 45 percent of their time training and 55 percent of their time at the unit at an average level of productivity of 36 percent, then, by our formula, they produce about ($100 \times 0.36 \times 0.55$) or 19.8 effective man-years. We then sum across all years of service in the workforce to find the total number of expected steady state effective man-years.

Our analysis has three major implications. First, for a given end-strength, total effectiveness of the workforce—the number of effective or fully productive man-years provided by a given end-strength—increases under the following best practices option because each service member is more productive over the early years of his or her career.

Second, for a given level of desired output, the size of the workforce required to produce that level of work—the number of authorizations—eventually declines (nearing the steady state) as more highly trained and productive members move through the grades. Third, the level of work required is held constant and the current retention profile—average number of years a service member serves—is unchanged, the number of students that need to be trained to support that workforce also eventually declines, as the workforce becomes staffed by more productive members. These results are shown in Tables 5.9 and 5.10.

For example, looking first at Table 5.9, the Army currently trains about 132 active component members to support a workforce of slightly over 900. Under the current practice option and the current retention profile (the estimated length of service we can expect from each accessed individual, given current annual retention rates), we estimate that this translates into 705 fully productive surgical technologists. In the steady state, by adopting the more productive following best practices option, our analysis shows that for the Army:

- Given the current student throughput, total productivity would eventually increase by 3.7 percent, resulting in 731 fully productive man-years.
- Because individuals are more productive, holding output constant at 705 fully productive man-years, the Army could reduce total authorizations by 32, from 906 to 874, or 3.7 percent.

Table 5.9
Estimated Effect on Total Effective Man-Years in the Steady State, by Service and Option

	Army		Air Force		Navy	
	Current Practice	Following Best Practices	Current Practice	Following Best Practices	Current Practice	Following Best Practices
Current student throughput[a]	132		95		144	
Current force structure[a]	906		753		1,002	
Total effective man-years	705	731	589	624	784	799

NOTE: Cell entries show the number of fully productive man-years based on current student throughput

[a] Student throughput and force structure are assumed constant in the two options.

Table 5.10
Estimated Steady State Effect on Authorizations and Student Throughput, Holding Level of Work Constant, by Service and Option

	Army		Air Force		Navy	
	Current Practice	Following Best Practices	Current Practice	Following Best Practices	Current Practice	Following Best Practices
Total authorizations	906	874	753	711	1,002	983
Student throughput	132	127	95	90	144	141

NOTE: Cell entries show the number required to perform or support the current level of work.

- Given the current retention profile, this translates into a required student throughput of 127 to support that workforce, a decline of 3.8 percent.

  Similarly, for the other two services, we find that:
- Given the current student throughput, total productivity increases by 6 percent in the Air Force and 1.9 percent in the Navy.

- Holding output constant at the current level, we could reduce total authorizations in the Air Force by 42 and in the Navy by 19—declines of 5.7 and 1.9 percent, respectively.
- Eventually, in the steady state, the Air Force could induct five fewer students annually, and three fewer in the Navy need to be trained to support the reduced workforce (a reduction of 5.3 percent for the Air Force and 2.1 percent for the Navy).

Thus, overall, we find that, in the steady state, the increased productivity resulting from the longer training option could slightly lower authorizations and student throughput in each service, with small concomitant personnel cost savings accruing to the services in the long-term.

Implications of a More Effective Workforce

In some occupations, as we discussed above, when a workforce becomes more effective and proficient, then, for a given level of desired output, the size of the workforce required to produce that level of work—the number of authorizations—should eventually decline as more highly trained and productive members move through the grades. In addition, holding constant the level of work required and assuming current retention patterns, the number of students that need to be trained to support that workforce should also eventually decline, as the workforce becomes staffed by more productive members. In the case of the surgical technologist specialty, this savings in authorizations and costs may come about if individuals are fully trained when they graduate, thus eliminating or decreasing the need for a more experienced technician to supervise them in the operating room.

However, some characteristics of the medical sector may limit the ability to fully benefit from a more productive workforce. First, it is likely that the production function for medical services—particularly surgical services—is relatively inflexible because these services are produced in teams. Despite the greater proficiency of one member of the team, it may be difficult to increase the surgical workload or decrease the number of surgical technologists required. Despite this, some sav-

ings might come about if the need for supervision is reduced or eliminated in the early years of a service member's career.

Second, it may not be possible to reduce the number of surgical technologists assigned to small clinics because only one or two are assigned to a given unit. In this case, it would be impossible to reduce staffing even with more *effective* service members. However, as we showed above, technologists work primarily in large installations, so it would be relatively rare for units to have just one or two technologists.[6]

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[6] As part of our research, we asked the Air Force and Army how an operating room works and about the role of the surgical technologist in the OR. In the Army, in fixed facilities for normal, noncomplex cases, the OR is typically staffed by one anesthesia provider, one registered nurse, and one surgical technologist who acts as a scrub and is responsible for handing off instruments to the surgeon. There are extra OR technologists in the room in the following situations: (1) before the start of the operation, when they may help set up or clean the room, (2) in complex cases, where there might be multiple surgeons working on different parts of the body, or there is need for an extra runner, (3) in training, where a more senior technologist is instructing a less-experienced person. OR teams are not permanent.

In the Air Force, typically one operating room will be staffed with either one certified registered nurse anesthesiologist (CRNA) or anesthesiologist, one OR nurse, and one or two surgical technologists, depending on the procedure. In past years, the preference was to always have two technologists—one to circulate and one to scrub—but now there is sometimes only enough support to provide one technologist because of deployments. If the operation is an extensive procedure, two OR technologists will be present. Apprentices or 3-level personnel always have a trainer in the room. OR technicians do not belong to one team. They rotate in and out because they are expected to be jacks-of-all-trades. When they are on call or when they deploy, they have to be proficient in all tasks. The Air Force has no apprentice (3-levels) authorized for deployed medical teams.

According to our respondents, in neither the Army nor the Air Force is a trainee the only surgical technologist in the OR; thus, there is potentially a manpower savings by having fewer of them, requiring less of the qualified technologist's time for training and supervision. Also, in the Air Force, as we noted above, four medical centers and three large hospitals account for over 60 percent of all surgical technologists in grade E-4 or lower. Thus, there is certainly room for the limited changes in authorizations that we suggest are possible.

Calculating Training Costs

We make some simplifying assumptions regarding training costs. Training costs should include all the costs of operating the learning center, such as instructor pay, training equipment costs, and operations and maintenance costs for schoolhouse facilities. These costs exclude student pay.[7] As long as cost factors are uniformly applied, it is the difference in costs between the two training options with which we are concerned.

We assume that Phase I training at the METC costs $1,000 per student per week.[8] We assume that Phase II training taking place at local hospitals will require some supervision from the METC but less than during Phase II training. We assume a Phase II training cost to the METC of $250 per week, per student, simply because that amount is 25 percent of Phase I costs.

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7 We excluded student pay when addressing learning center costs across services. For example, as stated in AFI 65-503, the military pay appropriation is centrally managed by the Air Staff and one would exclude it to move from a global USAF perspective to an Air Education and Training Command (AETC) perspective of training cost. In essence, shortening or lengthening an initial skills training course does not change the end strength of the USAF or the military pay account. We recognize that increased numbers of days of training do add to the individuals account with fewer days available for authorizations in the operational Air Force. We account for this effect in our analysis through the productivity gains that allow for a reduction in both operating manpower and the individuals account over time. Moreover, AFI 65-503 states that cost factors data (which are derived from the AETC Cost Model) should be used for studies and analyses but not for budgeting purposes. We use these data to make a rough analysis of changes to the way training is provided and do not claim budget precision.

8 For the Army, we used the Army Manpower Cost Model, which provides the cost for initial skills training in specific military occupational specialties. For the Air Force, we used the Air Force Cost Factors contained in AFI 65-503. Each of these sources accounts for cost in different ways and for different course lengths. However, excluding student pay and allowances, costs to train in 4N1X1 (Air Force) and 91D (Army) are reasonably comparable—about $1,000 per week of training per person. Levy, Christensen, and Asamoah (2006) have estimated the training costs for surgical technologists in each service. Adjusted for time, their estimated costs also average around $1,000 per person per week of training, with Army costs being slightly lower and Navy costs being slightly higher. We use $1,000 as the approximate cost per week of training for each service.

To estimate the cost of the Navy HM 0000 course, we examined the course description from the ITRO reviews. The HM 0000 course consists of six weeks of online didactic training, three weeks of practical training in a laboratory, two weeks of clinical training, and three weeks of other training and activities. We assumed $50 per week for the online portion, $1,000 per week for the combined six weeks of practical and other training, and $250 per week for the clinical portion. Thus, on average, given these assumptions, the HM 0000 course costs $6,800 per student.

Table 5.11 shows estimated training costs under the two options for each service. Using the assumptions outlined above, training costs increase for both the Army and Air Force, as they move to the longer training option. The Army's training costs would increase by about $220,000 per year or 14 percent over the current practice option. The Air Force faces a somewhat higher increase in training costs: about $330,000 per year or 33 percent over the current practice option.[9]

For the Navy, as mentioned above, we estimated the cost of using the following best practices option with and without the HM 0000 course. If the Navy decided not to train its surgical technologists in the HM 0000 course, it could save about $1 million or 33 percent in total training costs.

Summary of Cost and Productivity Findings

The methodology used here enables us to directly compare different in-house training options for producing trained and qualified surgical technologists. The analysis was based on the expert opinions of supervisors about the proficiency of individuals at the graduation point and in the early years of their career. The analysis showed that the following best practices option—which trains service members to the qualified

[9] The Air Force recently increased the length of its training by 32.5 hours. Because this information was received only recently, we were unable to incorporate the change in our analyses. However, the increased length will have only a small effect on the costs calculated here. The cost differential for the Air Force for moving from the current practice to the following best practices option will be slightly smaller.

Table 5.11
Total Training Costs, by Service and Training Option

Training Option	Training Time (years)	Steady State Student Throughput	Total Training Costs ($)
Army			
Current practice	0.45	132	1,650,000
Following best practices	0.66	127	1,873,250
Air Force			
Current practice	0.54	95	997,500
Following best practices	0.66	90	1,327,500
Navy			
Current practice (+ HM 0000)	0.93	144	3,103,200
Following best practices	0.66	141	2,079,750

level in the learning center—produces more effective total man-years than the current practice option does. However, this result needs to be balanced against the higher training costs.

However, implementing the following best practices option and gaining its benefits are not straightforward. The timing of the increased costs and benefits and determining to whom they accrue are issues that need to be addressed. In terms of timing, there is a real up-front and continuing budget cost to the METC to begin and maintain the new longer training program for all services. As we discussed above, savings would accrue to the services or the defense health program overall, provided it was possible to reduce the number of authorizations and, eventually, student throughput.

We now examine the effect of these in-house training options on other important issues: service culture and recruiting and retention.

Effect on Service Culture

The in-house training options are quite similar to what is currently being done by the services and, as such, should have little effect on service members' opportunity to gain exposure to service culture. Service members will receive basic training before being trained as surgical technologists at the METC. Although the training will be consolidated, service members will be housed separately and their health, welfare, and discipline will be the responsibility of their own service. Once they have graduated, service members will have the opportunity to acquire surgical technologist skills within their own service, which will allow for significant acculturation. Thus, we do not expect a significant effect on the ability to be indoctrinated in and acculturated to one's own service culture.

Effect on Propensity to Enlist and to Remain in the Service

Compared to the status quo, the following best practices option is a change only for the Army and Air Force. Recruits will be offered the opportunity to acquire the CST certification on completion of training and this may be an incentive to enlist. This may be particularly true among reservists, who might feel that a CST credential would position them for higher-paying jobs in the civilian world.

The effect on the propensity to stay in a service is somewhat harder to predict. Except for the Navy, the current practice option does not provide the advantage associated with the opportunity to acquire the CST certification but it is not clear that this has or will necessarily deter future enlistment in the Air Force or Army. Longer OJT—the current training philosophy of the Air Force—may provide greater acculturation and the opportunity to develop a greater taste for the military lifestyle, in which case enlistees may be more likely to commit to further military service. Presumably, given the Navy commitment to the longer training program, that service will find ways to continue to train to the qualified level.

If all services moved to the following best practices option, graduates would have the opportunity to obtain the CST credential. Although being credentialed would make them more attractive to the civilian sector, wages are somewhat lower in the civilian sector. Military personnel in at least the Army and Air Force will receive more training than they do currently and will receive more support to achieve civilian credentialing. This may provide greater job satisfaction, increasing the likelihood that they will stay in the service. If additional training and credentialing are linked to greater opportunities for advancement in the senior noncommissioned officer (NCO) ranks, then career progression and retention will be improved.

CHAPTER SIX

Other Options for Obtaining Qualified Surgical Technologists

This chapter briefly summarizes our findings on two "buy" options: hiring trained civilians as lateral entrants and outsourcing training to civilian institutions. (Appendix G reviews prior research on these two options.) As before, our analysis focuses on the cost implications; opportunities for acculturation to service values, beliefs, and attitudes; and recruiting and retention. The end of this chapter provides a brief overview of the option to civilianize military billets.

Lateral Entry of Trained Civilians

This option calls for hiring trained surgical technologists, sending them to basic military training, and offering them a two-week course in military medicine to get them up to speed before they are posted to units.

Effect on Costs

Recruiting a high-quality graduate (high school diploma and in the upper half of the qualification test) is expensive. Table 6.1 shows our rough cost estimate for 760 annual surgical technologist entrants. For entry costs, we take a very conservative approach and estimate $2,000 per entrant in added recruiting costs (over and above what the DoD already invests to recruit a high-quality entrant) and an additional $3,000 for an enlistment bonus. These costs are above the

Table 6.1
Approximate Cost Trade-Offs from Recruiting Trained Personnel

Cost Category	Savings ($)	Costs ($)
Entry		
Cost to recruit		1,520,000
Bonus		2,280,000
Instructional		
Instructional delivery	19,000,000	1,520,000
Instructors	3,595,635	239,709
Pay of students (composite)	15,810,660	1,403,077
Other		
Individuals account	Less	Baseline
Training attrition	Less	Baseline
Academic facilities	About 5% less	Baseline
Housing facilities	About 5% less	Baseline
Cost summary	22,595,635	5,255,914

current surgical technologist baseline recruiting costs. Recruiting costs could be lower for these reasons: (a) Using innovative approaches to this market to give recruiters incentives might reduce costs,[1] (b) currently there is no enlistment bonus for this specialty and because civilian compensation is lower than military compensation, the military might be an attractive employment option even without the bonus.[2]

[1] Golfin (2006) suggested a novel approach—using civilian recruiters with the incentive of a fixed payment per person only after the enlistee successfully completes military training and other milestones.

[2] As discussed in Appendix H, this occupation meets the characteristics for successful lateral entry outlined by Levy et al. (2004)—relatively high military training costs, availability of a fairly large pool of entrants with advanced training, and similar or lower wages in the civilian occupation.

In the baseline, as in this option, a new entrant would attend basic training. From there, an introductory two-week course would be provided in a temporary additional duty (TAD)/TDY status at Fort Sam Houston before assignment to an operational unit. The cost of this is more than offset by the reduction in costs of training a surgical technologist in house. We also reduce the number of instructors by 45 but add three back in for the two-week introductory course. Moreover, there is a large savings in student pay from the overall reduction in length of training (25 weeks to two weeks). In addition, for an equal length enlistment, far more of that time is spent productively in an operational unit.

The softer costs appear to favor the option of recruiting trained personnel. The individuals account (trainees) will be smaller; training attrition should reduce if for no other reason than less time is spent in training; and academic and housing needs at Fort Sam Houston should be about 5 percent less than otherwise. Overall the savings greatly exceed the costs.

Effect on Service Culture

Under lateral entry, service members will have less opportunity to acculturate and learn their service's practices, values, and norms. As Levy et al. (2004) point out, programs need to be "designed either to minimize anticipated cultural disruption or to manage cultural change." All services may resist lateral entry for surgical technologists to some extent because of acculturation concerns, although this could be mitigated somewhat by the eight weeks of basic training. Presumably, being older and more mature, these individuals may be more committed to the service culture; on the other hand, they may find it more difficult to adapt to a more regimented lifestyle. As the studies reviewed in Appendix G point out, a further concern is whether such individuals' peers resent them for coming in at higher pay grades, perhaps with promises of faster advancement. This may lessen unit cohesion and morale.

Effect on Propensity to Enlist and to Remain in the Service

Under lateral entry, it is likely that the services would need to offer some incentives to CSTs to get them to abandon their civilian career for a

military career. This may increase the propensity to enlist (particularly as civilian compensation is much lower than what the military offers). Some CSTs may have a taste for the military or may perceive that they will have greater opportunities in the military than in the civilian world, either as instructors or in other enlisted leadership positions.

This option might well increase the likelihood of remaining in the service, if these trained surgical technologists are offered faster promotion or if they have a strong interest in military service and late-career opportunities.

Outsourcing Training to Civilian Institutions

Another option for obtaining qualified surgical technologists is to outsource training to civilian community colleges and other training institutions. Under this option, a service member would spend eight weeks at basic training and then would enroll in the civilian program. We found that average course length was about 50 weeks in programs that were of sufficient size to accommodate military trainees or offered the program several times a year. Thus, we posited that the civilian course (both Phase I and Phase II) would last about 50 weeks, after which the service member would return to the METC for an additional two-week orientation in military medicine.

Effect on Costs

As noted above, many community colleges and technical training schools produce surgical technologists in the United States. We categorize these institutions in three ways: large institutions (often with campuses in several states) with frequent class starts; medium institutions with less-frequent class starts; and small institutions with infrequent (annual or less) start dates. We examined tuition for course lengths of approximately 52 weeks, which is about twice the length of courses provided by the military. In the larger institutions, tuition costs about $18,000 per student annually, and in the medium-sized institutions it is about $8,000 per student.

The cost estimates are shown in Table 6.2. As discussed above, we used an average cost of around $1,000 per person per week of military-provided training. There are both savings and costs from civilianizing training. Entry or accession costs should be similar in either

Table 6.2
Approximate Cost Trade-Offs for Using Civilian Institutions to Train

Cost Category	Savings ($)	Costs ($)
Entry		
Cost to recruit	Baseline	Neutral
Bonus	Baseline	Neutral
Training		
Tuition (high)		13,680,000
Tuition (medium)		6,080,000
Other student-related costs	Baseline	Marginally higher
Instructional delivery	19,000,000	1,520,000
Instructors	3,595,635	
Administrative		159,806
Supervisory		399,515
Pay of students (composite)	Neutral	17,213,737
Other		
Standardization	Baseline	Less
Acculturation	Baseline	Less
Individuals account	Baseline	More
Academic facilities	Baseline	About 5% less
Housing cost (BAH)	Baseline	Included in composite rate
Cost Summary		
High tuition	22,595,635	31,453,058
Low-medium tuition	22,595,635	23,853,058

case. Tuition costs are for the two different programs mentioned above. Some additional student costs are expected from attendance at civilian institutions as well as some savings. Savings accrue from reducing the costs of instructional delivery at the METC. Moreover, we estimate that the cost of about 45 instructors could be removed in addition. We add back about five persons for administrative and supervisory duties associated with the civilian institution option. Since the length of the course in the civilian institutions is double that of the military course, we add a half-year of pay at the E-2 composite rate to the costs.

The table also shows some of the softer costs we did not explicitly consider. Depending on the institutions used, there is some loss of standardization of education. In some respects, this is minimized if certification of students is achieved and some military instruction is provided at the end of the civilian training. (We estimate this to be one to two weeks at Fort Sam Houston with personnel in a TAD/TDY status. This is accounted for in the rows for instructional delivery and student pay.) The individuals account (trainees) would be increased in each service because of the longer training time. But, since surgical technologists account for about 5 percent of students at the METC, in theory many facility and equipment needs could be reduced by that amount; in reality, this would not occur in the short run. One cost is not included in the table—our assessment of in-house training showed that training personnel fully and then moving them into operational environments where they can be productive improves overall productivity or allows for reduced manpower. Adding six months to training counteracts that: Personnel remain unproductive for a much longer period of time than with the in-house training options.

The cost summary at the bottom of the table implies that training surgical technologists in civilian institutions would most likely not be a less-costly solution using the factors we assessed. Using medium-level programs with lower tuition appears to be about a break even, but many of the softer costs work against this option. If the METC were able to negotiate reduced tuition or shorter program length, then the option of using civilian institutions has more merit.

Our results run counter to the CNA study of the medical laboratory technician (MLT) program discussed in Appendix G. That study

found that a program at Thomas Nelson Community College (TNCC) produced higher-quality graduates at a lower cost per graduate with estimated savings of 6 to 15 percent per graduate while maintaining student satisfaction with the training and military quality of life, military bearing, and end-user satisfaction. The activity (general) costs of training were about 5 percent higher with community college training but the course-specific costs were about 15 percent lower. The biggest trade-off was between tuition and having fewer Navy instructors.

We offer two reasons for the difference between the CNA results and ours. In the MLT pilot, civilian and military courses were of equal length; in our case, using data on civilian course lengths, we assumed that the civilian surgical technologist course would be about 50 weeks or almost double the length of the military course. In addition, the MLT tuition was slightly less than $6,000 per graduate, which is significantly less than the tuition we estimated.

Effect on Service Culture

Under the option of outsourcing the training of surgical technologists to civilian institutions, service members will participate in basic training before leaving for their training, but they may be less likely to identify strongly with their service and more likely to think of themselves as surgical technologists who happen to be in the military. They will return to the military having been trained in the civilian world for almost one year, and over this period of time, they will not have had much (if any) opportunity to acculturate. Thus, acculturation and indoctrination into a service's culture and values will be a real concern.

Effect on Propensity to Enlist and to Remain in the Service

Outsourcing training to civilian colleges may have a positive effect on recruitment, as other students learn about military opportunities from their military peers. The opportunity to have their training paid for, especially if the program allows them to pursue a CST credential, could be a strong recruiting tool for the military. Outsourcing training may decrease retention, however, for a number of reasons. First, the civilian training program will expose service members to a less-regimented way

of life and to civilian employment opportunities that may attract those without strong ties to the military. Second, senior enlisted members value the opportunity to serve as instructors; in particular, Navy senior enlisted personnel value instructor tours as desirable shore duty. Without this opportunity, they may leave the military.

Civilianization of Military Billets

The last option we considered was conversion of surgical technologist billets to civilian positions. Under this option, the services would recruit trained surgical technologists who would remain DoD civilians.[3] Although the National Defense Authorization Act of FY 2008 placed a statutory moratorium on conversions from October 1, 2007, through September 30, 2012, this issue may well come up again in the near future.[4]

Effect on Costs

We did not attempt a cost analysis of the option, given that it is on hold. However, our review of prior studies indicated that the cost methodology used to justify conversions is not well developed and does not take all the relevant costs into account (see Appendix H).

Effect on Service Culture

Under this option, there should be little effect on service culture unless the very act of converting positions lowers morale and military commitment. An important issue that arises is whether and how civilians would deploy during wartime, if they were needed. This would suggest that some positions need to remain as military ones and the services would need to grow these individuals and give them the experience

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[3] The services have had some problems filling billets that were converted to civilian positions. For example, from 2005 through 2007, the Air Force was able to fill only seven out of 22 positions it had converted to civilian positions (Air Force comments on an initial draft report, July 2008, unpublished).

[4] U.S. Government Accountability Office (2008).

to be fully mission-effective. Obviously, this would curtail the savings that otherwise might accrue from completely civilianizing the occupation. Some cultural and morale issues might also arise if civilians and military surgical technologists work side by side in military treatment facilities (MTFs), perhaps with differential compensation and different deployment demands. This would also mean that the military specialists would be deployed more frequently than would be the case with a larger pool from which to draw.

Effect on the Propensity to Enlist and to Remain in the Service

If all the military surgical technologist positions were converted to civilian positions, this point would be moot. However, if some positions remain military ones, it is unclear what effect this might have on new recruits and on more-experienced enlisted personnel or why it should affect them in one way or another. It is possible that individuals may find it more attractive to be DoD civilians, if they are called on to deploy more frequently, in which case we might see a decline in retention.

Summary

Recruiting trained civilians to join the military seems to be the most viable of the buy options, given the lower average salaries paid to civilian surgical technologists. Moreover, there appears to be a ready supply of entering surgical technologists who have provided their own education in the various training programs that exist. A pilot test of recruiting already trained personnel should be considered. It may well be that focusing recruiting on those who are not in accredited programs or do not achieve certification may be an easily penetrated market with an appeal of providing a route to certification. However, the service recruiting organizations may need specialized training and incentives to make this niche viable. Among the other benefits, a person already trained, enlisted for the same duration, provides full productivity for a longer period of time than one trained by the military to full capabil-

ity. As we have amply demonstrated in the previous cost calculations, productive time matters.

Using civilian institutions to provide training to the fully qualified level has some drawbacks. The civilian programs take from nine to 24 months and even at the lower end, too much of an enlistment or a career is devoted to education and training with a loss of productive time in a unit. Moreover, longer training up front adds to the individuals account at the expense of organizational manpower, and administrative, supervisory, and housing costs could be considerable. If programs were found near military bases and if housing and supervision were available, it would be less costly than finding housing and providing supervision in other locales. Such costs could be prohibitive, even though the METC would have less of a housing and supervisory burden and fewer faculty requirements at Fort Sam Houston. Nonetheless, if the military needs additional clinical sites for Phase II clinical training, it may be viable to outsource part of the regular training program to these institutions.

CHAPTER SEVEN

From Common Work and Training to Interoperability

In recommending the establishment of the METC to oversee and provide medical enlisted training across the services, the BRAC report largely focused on the short-term objective of efficiency, looking to greater economies of scale to lower costs as services trained together. The BRAC, however, also noted the desirable effect of common training on interoperability. The QDR's primary focus is this longer-term objective of interoperability. For example, QDR Initiative #2 has an objective to "improve the joint capabilities, agility, and interoperability of the medical force. . . ." In a similar vein, QDR Initiative #5 states that "Medical education and training must prepare medical personnel for future requirements, improving overall capabilities and increasing joint medical interoperability and deployability among the services." Ultimately, the purpose is to enhance the capability of the medical forces to achieve their mission.

This chapter examines how to achieve the two objectives of efficiency (lower cost) and interoperability and the interaction between them. The commonly held misconception is that common work will lead to common training and, in turn, to greater efficiency and greater interoperability. Whether these objectives are achieved depends on a host of factors; in particular, as we show, although the efficiency objective may be straightforward to achieve, the link between common work, common training, and greater interoperability is not as direct.

Achieving Efficiency

The efficiency objective is easy to understand: to lower the cost of producing a trained specialist by training together. Currently, each service trains in its own facilities using its own curriculum and training philosophy, requiring significant duplication of facilities, equipment, and other instructional resources. By having the services train together at the METC to a common standard, economies of scale could be realized in these expenses, reducing the per unit cost of producing a qualified technician.

The extent to which a training curriculum is consolidated to achieve efficiency depends on several factors.

Common Standard of Practice

First, the services need consensus on all or a substantial part of an SOP for a given specialty, i.e., the common occupational tasks that a specialist should be able to do at a common proficiency level and the knowledges and skills that the specialist should possess. To obtain consensus on a common SOP, the services need to consider (a) structural factors including resources, organization, materiel, systems, facilities, and technology applicable to that specialty; (b) medical factors including required proficiency levels, certification, civilian comparability, and standard of practice; and (c) military factors including doctrine, operational employment, and missions (e.g., beneficiary, readiness, homeland defense, and defense support to civil authorities).

Resolving larger issues that cross occupations such as better aligning military occupations with civilian occupations, certification, levels of proficiency at entry into and at completion of training, and standard of practice appear important to achieving the SOP. Military and structural factors (in particular, how the services employ these individuals and how units are organized and deployed) must also be considered. Moreover, going forward, the curriculum must begin to align with joint doctrine and context.

The reviews being conducted by HC ITO are aimed at defining common training and curricula in an interservice context and not identifying a common standard of practice, as we have outlined in this

monograph. Nonetheless, we believe that defining a common standard of practice is and should be a precursor to identifying and implementing common training. A consensus regarding common training has, at its heart, an understanding of and agreement on the common SOP for a specialty, regardless of whether it is explicitly acknowledged.

Training Policy and Procedural Factors

Second, the services need to agree on training policy and procedural factors to include amount of precourse preparation, use of blended learning and self-paced learning, and overall training philosophy/strategy (e.g., the mix of classroom and OJT that leads to specialty qualification).

Service Culture

Third, the ability of personnel to train together and to benefit from it will be affected by service culture, defined as the values, attitudes, and beliefs that motivate behaviors.

Training Resources

Fourth, common training may be constrained by the resources available for training. In particular, this may become an issue if the bill for a particular service goes up sharply because of course consolidation.

The extent of consolidation of training for a specialty is directly proportional to the amount of common work in a specialty and depends directly on the last three factors. Training curricula, however, are not likely to be completely consolidated—which is when maximum efficiency would be achieved—without resolving the training policy and procedural factors and shaping the climate and culture in common directions with respect to "jointness."

Achieving Interoperability

The interoperability objective is more complex and less understood, partly because it is difficult to define precisely. Most people are familiar with the standard DoD definition of "interoperability" as "the ability

to operate in synergy in the execution of assigned tasks."[1] The DoD also defines "interoperation" as the use of interoperable systems, units, and forces. The acquisition community has done the most with understanding the concept of interoperability. In fact, all acquisition programs must satisfactorily address interoperability.[2] Moreover, in acquisition, standardization advances interoperability through commonality of systems, subsystems, components, equipment, data, and architecture. The acquisition community has also gone a long way beyond definitions toward making the concept of interoperability workable as a key performance parameter. A good explanation of interoperability is found in a paper that describes best practices in software acquisition, "Ensure Interoperability." The Military Health System, the individual services, and the METC should find both the explanation and the cautions useful as they struggle with the interoperability objective:

> The definition of interoperability encompasses **both a <u>technical</u> and an <u>operational</u> capability**. The technical capability (ability of systems, units, or forces to provide services to and accept services from other systems, units, or forces) addresses issues of connectivity among systems, data and file exchange, networking, and other communication related scenarios. The operational capability (ability of systems, units, or forces to use the services so exchanged **to enable them to operate effectively together**) addresses the degree to which value is derived from that technical capability. Identifying technical requirements for interoperability is challenging but straightforward; ensuring "effectiveness" of the technical solution is much more complex because the operational environment in which effectiveness is assessed is a moving target.

1 Department of Defense (2008).

2 DODD 5000.1 (Department of Defense, 2003) states as policy:

> Systems, units, and forces shall be able to provide and accept data, information, materiel, and services to and from other systems, units, and forces and shall effectively interoperate with other U.S forces and coalition partners. Joint concepts and integrated architectures shall be used to characterize these interrelationships.

The need to address interoperability is stated everywhere in the literature. Everyone says "Make it happen" but few are saying exactly what activities are necessary to "make it happen". This is due in part to the "vastness" and complexity of the issue and the fact that many different factions (people and organizations) have a role to play. If you are a program manager responsible for a national security system your activities for ensuring interoperability are vastly different from the activities of a commercial developer making network components. If you are an acquisition specialist responsible for contracting language your activities are different than those of the requirements analyst. **The <u>practice</u> of ensuring interoperability therefore involves recognizing the complexity and understanding the scope of the interoperability issue with respect to the particular system and your particular level of involvement before taking action.** This awareness establishes the framework for identifying **all** of the stakeholders and drives requirements definition, planning, and decision making for the remainder of the effort. Because of the ever-changing operational environment over time, interoperability is never "done". **There must be a process for assessing/evaluating the degree of interoperability among "systems, units, and forces" over time and making adjustments as the technology and operational needs change**. Although this practice is primarily aimed at military functions there is the notion that there are things that can be done in a general sense to ensure the ability of a system to interoperate with other (yet to be defined) systems in the future.

. . .

By definition, interoperability extends beyond the boundaries of any singular system, project, or program. To command the developer to make a system "interoperable" without providing further scope is meaningless. The challenge lies in identifying all the stakeholders and "communicating" across programs, and across organizational boundaries in order to clearly define the level of interoperability that is required and the participating systems.

- Interoperability is not a binary state. There are different degrees (or levels) of interoperability and different kinds of interoperability. It is impossible to say "system A is interoperable but system B is not". Someone has to emphatically state how much interoperability (what level? what functionality?) is necessary and what systems constitute a particular interoperability domain. Whose job is that? Who truly understands which of the thousands of systems that exist truly need to interoperate, and at what level? How do developers acquire this "big picture"? What organizational structures and activities are necessary to support this type of communication? How is this activity funded?
- Interoperability is a volatile attribute of any given system because the requirements of any given system in the domain may change, as well as the impact of technology insertion. Both factors may alter the interoperability state across the domain and necessitate re-assessment and corrective actions to "sustain" a desired state of interoperability.
- How is interoperability funded? Solving the interoperability issue often involves collaboration among many organizations. How does each organization support that essential activity? Testing and evaluation is significantly different for interoperability than it is for other program attributes. Who should perform the testing? How is testing funded?
- How is interoperability communicated? What practices must be put in place to ensure that interoperability assessments (evaluations) are consistent across the domain? What measures (and criteria) should be used to communicate the status of interoperability among the participants in the domain?
- Demanding interoperability does not guarantee it will be realized. In many situations the technology is not sufficiently mature enough to meet the demand. Acquirers need to find a balance between what is desired (or needed) and what is technically possible. Someone needs to be looking ahead at the various research efforts now going on that are

> addressing interoperability challenges. [Boldface and underscore in original.][3]

Interoperability in the Medical Arena

For the medical arena, the basic essence of interoperability can be captured in a working definition espoused by the Joint Interoperability Test Command as "the ability of people, procedures, and equipment to operate together effectively and efficiently under all conditions of battle."[4] The people and procedures aspects of interoperability are vital.

Interoperability can occur at several levels. For example:

- Interoperability at the person level means the increase in capability that can occur when a service member from one service can be substituted for a service member from another service in their military role. Members of the FOSC have stated this as "any tech could work at any of our facilities." Interoperability at the person level requires that all trained personnel in a specialty be trained to a common level and a common SOP although a service may choose to train beyond that common SOP.
- Interoperability at the unit level means the increase in capability that can occur when a unit from one service can be substituted directly for a unit from another service in its military role.
- Interoperability at the forces level means the increase in capability that can occur when services operate jointly in the same theater of operations, on the same mission.

At the person level, characteristics (occupational attributes or specifications) can be specified more precisely with less needed tolerance around the specification. It is possible to have a common standard of practice and common training. Moving from the person level

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[3] The Data & Analysis Center for Software (n.d.).

[4] Joint Interoperability Test Command (2001).

makes interoperability more difficult because of the dynamic nature of military operations, systems, and technology improvements. This monograph is focused on the person level of interoperability, recognizing that other levels exist.

If the DoD were to train service personnel to common SOPs, this would yield greater person-level interoperability and would help increase the capability of the military to staff units for deployment in several ways. First, if units could be staffed by personnel from multiple services, there would be a larger pool of deployable personnel from which to select when forming units for deployment—analogous to individual augmentees. This would increase the total capability of the DoD to deploy medical units. Second, if more CONUS home station units could be staffed with personnel from multiple services, there would be a larger pool of personnel to backfill for deploying personnel. For example, consider an Air Force enlisted medical airman whose home station unit is a jointly staffed medical facility. When this airman is selected to join a deploying medical unit, his or her position at the CONUS facility can be backfilled by a service member from any service. This flexibility will increase the overall capability of the DoD to form deployable units.[5] Third, if being trained to civilian standards enables reservists to obtain employment in occupations related to their military medical specialty, this would enhance readiness and lower the need for training when reservists are mobilized.

Being functionally or occupationally interchangeable does not mean that personnel are exact replicas in every other way. The skill set can be functionally interchangeable (or mutually substitutable) among soldiers, sailors, and airmen so that a qualified Air Force surgical technologist could staff an Army MTF and be indistinguishable occupationally from a comparably trained and experienced Army OR technician. However, the Air Force technician would be wearing a blue uniform, would have been inculcated with Air Force values and atti-

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[5] This is a similar concept to risk-pooling in management science. When an asset can be used to fill more than one type of demand, the total required inventory for the class of assets is reduced. Since assets can be used flexibly to fill demand, the total amount of assets that must be maintained to meet the unpredictable demand is reduced. Or, an even greater level of expected demand can be met with a similar total inventory across the class of assets.

tudes, and would have an Air Force career and retention pattern that is different from an Army pattern. So differences would still exist, but occupationally or functionally there should be none. In general, when surgical technologists graduate from the program, almost all of them are sent to work in a fixed facility operating room with very specific tasks. In principle, this is no different from Air Force surgeons doing rotations at Walter Reed Army Medical Center, for example.

Certain circumstances and missions may facilitate the ability to be interoperable; for example, if service members are serving in large tri-service fixed facilities such as at Landstuhl; if units are physically together to enable this kind of substitution during some missions; or when carrying out particular missions that traditionally draw from all services such as humanitarian missions conducted by Navy ships USNS Mercy or USNS Comfort. As individuals become more senior—particularly as they move into Petty Officer and NCO leadership roles—it becomes more difficult to substitute one for another because conditions change significantly and different tasks emerge (supervision, leadership, and management) even if all the functional surgical technologist tasks remain the same.

Further, in a deployed setting, differences matter more because services currently do things somewhat differently. However, according to our data and interviews, all new learning center graduates are employed in fixed facilities and are not deployed. Moreover, just because people are mutually substitutable does not mean that substitution would routinely occur—only that it could if needed. There is a concern that substitution would become the norm rather than the exception, but even that concern should not stop the METC from producing a standard product from the occupational standpoint.

For the Military Health Service, developing common SOPs and common training offers the means (technical capability) but taking advantage of this technical capability to operate effectively together to enhance overall operational capability requires addressing several doctrinal, organizational, personnel, materiel, leadership, and facilities issues. Levy et al. (2005) offer a useful look at some barriers. They convened a Medical Readiness Capabilities working group to examine how the services might become more joint in providing medical care

to military personnel. The working group used the doctrine, organization, training, materiel, leadership, personnel, and facilities (DOTMLPF) model to guide their discussion. We provide some illustrative examples in Table 7.1, excerpted from an appendix in the Levy et al. (2005) report. Enhancing interoperability requires addressing both large and small issues.

It is important to keep in mind that interoperability as an objective affects the other objective, efficiency. Interoperability, which produces greater capability, may be gained at a higher price—for example, training all specialists to a higher level of proficiency than is currently the norm may make them highly interchangeable but comes with higher training costs. As long as costs increase at a lesser rate than effectiveness, interoperability could still be more efficient. But it is rare that "doing more with less" is achieved. This may be good rhetoric, but it is difficult to achieve in practice. That does not mean that objectives for commonality or interoperability are not achievable. It may be that interoperability becomes more easily achieved in future years as other "transformational" initiatives are implemented (e.g., use of equipment and systems that are "born joint").

Breaking the high-level QDR demand for interoperability into meaningful and realistic steps increases the likelihood of achieving it. Sensible strategies are needed for migrating policies and procedures not originally designed for interoperability to function in new interoperable environments. Ultimately, such fundamental questions as the following need to be answered: What interoperability capabilities are needed? Who is the appropriate authority to identify needs? What regulations, conventions, and policies apply? How will understandings be communicated to all? What events must occur? Who should assess interoperability status? At some point, these must be decided either within or outside the METC before greater interoperability can be achieved.

Table 7.1
Potential Barriers to Jointness, DOTMLPF Issues

Issues and Selected Potential Barriers
Doctrine
Service-unique, not joint, doctrine supports medical functions in unique operating environments
Publications, forms, language, and acronyms are barriers to accessing information across services
Not all services use the same patient condition codes
Services approach to division of labor between line and medical is different (for example, in CBRNE decontamination or base operating support [BOS])
Own-service medical assets may have service-specific requirements that limit interchangeability but should not affect interoperability
Service-unique organization supports the medical function in unique operating environments
Units are not organized into capability-based modules to allow comparison, augmentation needs, replacement, etc.
Grouping of skill sets differs and therefore capabilities differ
Not all units with comparable capability sets have the same level of mobility capability
Training
Common basic orientation of all medical personnel in the DoD MHS is lacking
Education on service function mission and knowledge of what the sister services do are lacking
Individual service medical personnel continue to train with their own line counterparts only
Specialized training is required for unique service requirements (i.e., submarine or high altitude assignments)
Adequate joint theater-level medical training exercises are lacking
Materiel
A robust system for examining common equipment sets
There is a lack of common medical equipment sets and common nonmedical equipment sets (generators, communications, shelter, etc.)
There is a lack of common nonmedical equipment sets (generators, communications, shelter, etc.)

Table 7.1 (continued)

Issues and Selected Potential Barriers
There is no standardized formulary between like levels of care
Funding lines are not under joint control, lack joint funding stream to develop joint systems
Complete measures of capabilities and throughput are lacking
Information management/information technology differences exist
Leadership
There is no follow-through on defining joint medical training requirements
There is leadership uncertainty and little desire to change
There is a lack of a unified joint medical command
A requirement to develop joint leaders at a young age is lacking
Service cultures differ
Joint command and control synchronization of the delivery of force health protection on a highly mobile, operational, decisive, maneuver battlefield environment is lacking
Personnel
Personnel management systems differ
A requirement for joint duty and joint opportunities for future leaders are lacking
Rotation policies are different
Substitutability policies differ
Care extenders “medics” do not have equal capabilities
Adequate redundancy and flexibility in personnel to support the total mission are not ensured
Requirements for standardized competency in support functions are lacking
Facilities
Service medical units require different BOS
Air Force relies on BOS to employ
BOS required not included in some or buried within units

SOURCE: Excerpted from Levy, Trabert, and Dickens (2005).

CHAPTER EIGHT

Conclusions and Policy Implications

The METC being established at Fort Sam Houston, Texas, will be responsible for training enlisted medical specialties across the three services. Currently, the idea is to collocate the three service schools and to consolidate medical training for all services to the extent feasible to achieve cost savings through economies of scale. Another important objective is to enhance service interoperability.

Implementing common training for a particular specialty requires agreement among the services regarding the standard of practice for that specialty, i.e., a common capability set at a given level of proficiency that the specialist should possess at the end of training. We were asked to examine the feasibility of defining a common SOP for the surgical technologist specialty and the issues related to implementing a common SOP.

This monograph makes three important contributions. First, it outlines a methodology for defining a common standard of practice that can be applied to any specialty and illustrates the use of that methodology by applying it to the surgical technologist specialty. Second, it offers a way to identify and systematically evaluate the effect of different methods for training or obtaining qualified medical personnel on DoD and service objectives. In particular, it takes into account the total costs of training, including human capital development costs incurred for individuals who are not fully productive—a category of costs that is often ignored. Third, it examines the link between common work (SOP), common training, and interoperability and shows that getting

from one to the other is an extremely complex process, requiring fundamental changes in DOTMLPF.

The basic methodology for defining and evaluating a common SOP consists of three major analytical tasks:

1. Defining a common SOP for the specialty, using a variety of sources, both military and civilian.
2. Validating the common SOP with SMEs from both the military and civilian sectors to ensure that the standard of practice is comprehensive and reflects a common understanding, rather than service-unique capabilities.
3. Identifying and evaluating options for achieving a common SOP, which includes identifying a set of training options for “making” or “buying” trained individuals at that level of proficiency and evaluating these training options against the criteria of cost and effect on service culture, recruitment, and retention.

Findings on Defining a Common Standard of Practice for the Surgical Technologist Specialty

This specialty includes the Army’s Operating Room Specialist (68D), the Navy’s Surgical Technologist (HM 8483), and the Air Force’s Surgical Services Apprentice (4N131) and Surgical Services Journeyman (4N151). We grouped these three specialties under the common term “surgical technologist.” In developing the common SOP, we pegged it to the “qualified” level, i.e., a level of proficiency to be expected from graduates of accredited programs and eligible for professional certification as certified surgical technologists. We validated our draft SOP with SMEs from the services.

Our findings with respect to the feasibility of developing a common SOP across the services for this field are as follows:

- This is a well-established profession with defined roles and responsibilities, and the nature of work and work context are similar between civilian and military specialties.
- There is reasonable agreement on the standard of practice for surgical technologists among service representatives.
- Accreditation and certification processes exist and appear to be well defined in the civilian world.
- A clearly articulated curriculum, *AST's Core Curriculum for Surgical Technology*, is the basis for all accredited programs and could help guide the process of obtaining consensus from the services with respect to a common SOP.
- Defining a common SOP is feasible but needs to be directed by the FOSC.

Findings on Options for Obtaining Qualified Surgical Technologists

We identified four options for training or obtaining qualified surgical technologists:

- in-house training, which included the two variants identified by the ITRO reviews
- lateral entry of trained civilians
- outsourcing training to civilian institutions
- civilianization of the military surgical technologist positions.

Our focus was largely on in-house training, given the stand-up of the METC. We evaluated the effect of the two in-house training options on the effectiveness of the workforce using data provided by supervisors and experienced technologists regarding the proficiency of individuals throughout their career. The following best practices option, which provides training to the qualified level in the learning center, appears to be the preferred option of the two in-house training options on three dimensions. First, having more proficient personnel results in an increase in the overall effectiveness of the surgical techolo-

gist workforce. Second, it follows best practices in terms of being an accredited program leading to professional certification—two avowed goals of the METC. Third, it produces greater interoperability.

However, implementing this option and gaining its benefits are not straightforward. If the production function for surgical services is relatively inflexible or if some clinics have one or two surgical technologists, then it may be difficult to reduce manpower in a more effective workforce. However, there may be some savings in the time needed to supervise, train, and evaluate individuals, and this might allow reductions in manpower. In terms of training time, there is a real upfront and continuing budget cost to the learning center because of the longer training time required by the following best practices option. In addition, the costs accrue to the METC whereas the savings will be reaped by the services or the defense health program.

We also recognize that a number of other factors would need to be resolved before moving to the following best practices option, including changes in DOTMLPF; concerns about not being able to meet training program requirements in the Air Force; issues about qualifying Air Force and Army faculty as certified surgical technologists to meet accreditation requirements; ensuring that a sufficient number of clinical sites can offer the longer Phase II training; and policies on recycling individuals who fail to pass the certification examination.[1]

As suggested by the Army, one way to move ahead would be to establish a tri-service task force that builds on the work done by the HC ITO to translate commonalities in the standard of practice into portions of the overall training curricula and also resolves some of the issues identified above.[2] Common training with a fully consolidated training curriculum should be seen as a long-term goal.

Of the other three, recruiting trained civilians to join the military seems to be the most viable of the buy options and seems to offer substantial savings in the overall costs of producing a fully effective worker.

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1 Another important issue that needs to be considered is the effect of longer training and certification requirements on reservists. Examining this issue was outside the scope of the study.

2 Army comments on an initial draft report, July 2008, unpublished.

For an enlistment of the same duration, a person already trained provides full productivity for a longer period of time than does a person trained by the military to full capability. In addition, civilian salaries seem somewhat lower than military salaries for this occupation and a relatively large supply of surgical technologists exists in the civilian sector. We recommend a pilot test if the services wish to consider this option to establish its feasibility.

We evaluated each option separately and on its own merit. In reality, the best way to produce or obtain qualified surgical technologists might be combinations of different options—for example, in-house training as well as lateral entry of trained civilians.

From Common Training to Interoperability

Common training may be cost-effective, as required by the BRAC, lowering the overall costs of producing a trained enlisted medical specialist. However, there is no direct connection between common work, common training, and interoperability. Yes, common work will enable common training and, in turn, common training will set the stage for interoperability at the person level. However, for individuals and units to be truly interoperable, a number of factors need to be aligned, and fundamental changes will be required in areas such as doctrine, organization, and materiel.

Thus, whether the services will be able to take advantage of interoperability at the person level to achieve greater interoperability at the unit and forces level is an open question. It is a long road from one to the other. It may be that interoperability is more easily achieved in future years as other "transformational" initiatives are implemented (e.g., use of equipment and systems that are "born joint").

APPENDIX A

The Interservice Training Review Organization and the Review Process

This appendix presents an overview of the Interservice Training Review Organization, its duties and responsibilities, and the process it follows in reviewing service training curricula for commonality across services. It focuses on the health care ITRO process, which is somewhat different from other interservice training review processes in that the reviews are facilitated by a permanent office, the Health Care Interservice Training Office, and there is a different reporting structure, as explained below.

Interservice Training Review Organization

> The Interservice Training Review Organization (ITRO) is an organization comprised of representatives of all the uniformed Services . . . ITRO coordinates the establishment of multi-service training solutions for common training requirements, enabling the participating Services to preserve training resources as expressed in terms of manpower, equipment, funding and facilities. ITRO consolidated and collocated training is designed to improve training effectiveness while maintaining or improving combat readiness and eliminating or reducing infrastructure.
> ITRO fulfills this mission by accomplishing the following responsibilities:
> a. Provide policy and guidance for interservice training.
> b. Review training and related activities to increase effectiveness and efficiency through:

(1) Course or curriculum realignments (consolidations/collocations)
(2) Area realignments
(3) Standardization
(4) Administrative or management improvement
(5) Evaluation
c. Assist the military Departments by performing special studies as directed.
d. Serve as a point of contact and provide a forum for the free interchange of ideas, information, and technology related to interservice training.[1]

The ITRO is overseen by the Executive Board (EB) composed of the following: (1) Army: Commanding General, U.S. Army Training and Doctrine Command (TRADOC); (2) Navy: Commander, Naval Education and Training Command (NETC); (3) Air Force: Commander, Air Education and Training Command (AETC); (4) Marine Corps: Commanding General, Training and Education Command (TECOM); (5) Coast Guard: Director, Reserve and Training, U.S. Coast Guard; and (6) Health Care: ITRO advisor for health care. The EB is assisted by a Deputy Executive Board (DEB) and a Steering Committee (SC), which coordinate the day-to-day activities of the ITRO. A series of major committees and subcommittees manage the ITRO process.

ITRO Health Care Process[2]

Unlike most other training, which is overseen by TRADOC or NETC, the Army and the Navy surgeons general directly control their training commands and funding. On the other hand, the Air Force provides health care training through the AETC. The Marine Corps does not have health care occupations; the Navy provides its medical and

[1] Interservice Training Review Organization (2008a), pp. 1-1–1-2.

[2] This section is excerpted from Interservice Training Review Organization (2008a). All quotations are from this document, unless otherwise noted.

dental support. The Coast Guard conducts some health care training. Because of the unique aspects of health care processes, the procedures and reporting for health care ITRO are different. The main areas of difference are in:

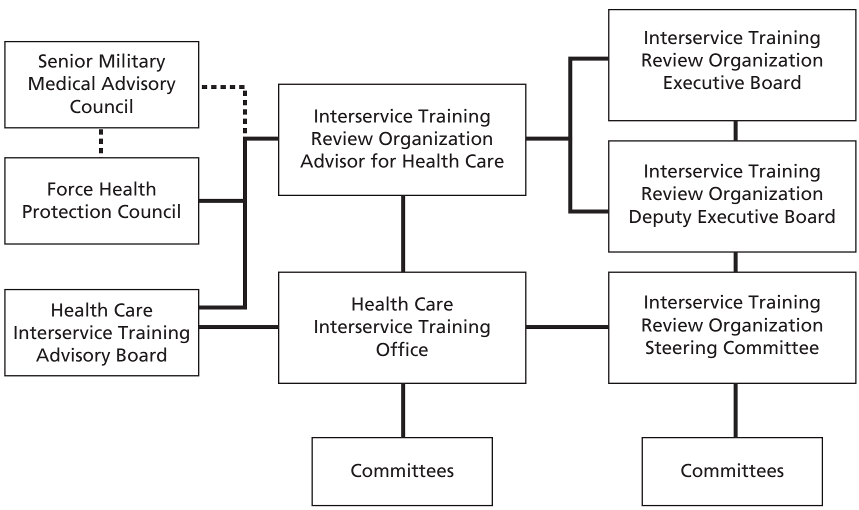
> (1) the health care chain of command within the Assistant Secretary of Defense for Health Affairs (ASD HA).
> (2) the decision process.
> (3) a permanent health care office (Secretariat).
> (4) accreditation, affiliation, and certification (p. 3-1).

Governance and Oversight

Figure A.1 shows the organizational relationships for the health care organizations for the ITRO process.

The Senior Military Medical Advisory Council (SMMAC) functions as a high-level advisory group and is chaired by the ASD HA.

Figure A.1
Health Care Organizational Relationships Within ITRO



SOURCE: Interservice Training Review Organization (2008a), Figure 3-1, p. 3-2.
RAND *MG774-A.1*

Members include the surgeons general from the three services (Army, Navy, and Air Force) as well as the Joint Staff (J-4) surgeon general, and four deputy assistant secretaries of defense.

The Force Health Protection Council (FHPC) is the primary source of guidance and direction and makes all the health care training decisions, but it delegates decision authority to the HC ITAB for all actions.

The HC ITAB is "the principal deliberative body within the health care interservice training structure. . . . The HC ITAB develops and approves plans and recommendations to achieve efficiencies in DoD health care training through consolidations, collocations, and the use of quota courses, outsourcing, the insertion of technology and the use of distance learning. The HC ITAB coordinates and formulates Service positions. It consists of one voting member per Service and other members as determined by each Service" (p. 3-3).

The ITRO AHC functions as the principal advisor and advocate for health care interservice training within the military health system and within ITRO. A naval medical department flag officer is assigned as the ITRO AHC and chairs the HC ITAB.

The HC ITO serves as a facilitating and staffing support office to the ITRO AHC and the ITAB. It serves as "the point of contact on health care interservice training for all military Services, Federal and State agencies, civilian academic institutions and associations, and other appropriate organizations" (p. 3-4). The office is managed by a director, who serves as the principal advisor to the ITRO AHC on health care interservice training and as the liaison between the ITRO AHC and the HC ITAB. The director also coordinates the activities and provides guidance to the HC ITAB and the various study groups and committees involved in the process.

The HC ITO AHC is a Navy medical department flag officer. To support the setting up of the METC pursuant to the BRAC report, the AHC moved the HC ITO from Bethesda, Maryland, to Fort Sam Houston, Texas. The HC ITO is an integral part of the METC transition and implementation team.

Study Process

As the Interservice Training Review Organization (2008b) notes:

> The ITRO training study process is intended to facilitate the establishment of consolidated and collocated training solutions. It is designed to support the ISD [Instructional Systems Development], also known as the Systems Approach to Training. The process provides a foundation for the analysis of training requirements, the development and implementation of training and the review of existing curriculum (p. 1-1).

Any service, member of the HC ITAB, or the HC ITO may request a study. With the concurrence of the HC ITAB service voting members, the HC ITO convenes a QLG, whose purpose is to determine if sufficient commonality exists between one or more services to warrant a formal study. The services appoint representatives to the QLG who are knowledgeable about their services' training skill requirements and are empowered to make reasonable recommendations for their service. Most QLGs are expected to be completed in three days and recommend whether to go forward with the more detailed analysis, based on a simple determination of feasibility including an estimate as to whether there is sufficient training commonality to justify consolidated or collocated training. If the QLG recommends a study, it will transition to a DAG. If the QLG members do not find sufficient commonality, they may recommend that the HC ITAB terminate the study or redefine study objectives. Should the QLG review result in a recommendation to not go forward, the study group needs to fully justify its recommendation and await further guidance from the steering committee or the ITAB.

The purpose of the DAG is to conduct an extensive analysis of the curriculum and resource requirements with the goal of consolidating/collocating training. The standard activities expected of a DAG include adopting the existing program of instruction (POI) or developing a notional POI for consolidation studies and curriculum reviews, developing course models, identifying training site options, determining the fiscal year for implementation, identifying options to be analyzed, and discussing certification and accreditation standards (if applicable), with

a view to maintaining accreditation as required or as agreed to by participating services.

The goal of the resource analysis phase is the "determination of the resource obligations to be incurred by each Service as a result of participation in an ITRO course" (p. 6-1). Standard activities for most RRA study committees include: conducting a manpower analysis, conducting a cost analysis, conducting a facilities analysis, developing the Plan of Action and Milestones (POA&M), if required, and determining the recommended training option.

The next steps are the decision and implementation phases. The DEB and ITAB are presented with the results of the previous studies along with a definitive recommendation. Implementation decisions are embodied in an Interservice Executive Order (IEO). On approval, the study committee transitions to the implementation phase, whose goal is "to ensure that all coordination required to commence training takes place and a transition of responsibility from the study committee to the Service training managers occurs" (p. 8-1).

APPENDIX B

Scope of Practice for Surgical Technologists as Defined by the Association of Surgical Technologists[1]

1. Responsibilities of the surgical technologist in the scrub role:
   a. Preoperative
      (1) don operating room attire and personal protective equipment
      (2) prepare the operating room
      (3) gather/check necessary instrumentation, equipment, and supplies
      (4) create and maintain the sterile field
      (5) perform surgical scrub
      (6) don sterile gown and gloves
      (7) organize the sterile field for use
      (8) count necessary items with circulator
      (9) assist team members during entry of the sterile field
      (10) expose the operative site with sterile drapes
   b. Intraoperative
      (1) maintain highest standard of sterile technique during the procedure
      (2) maintain the sterile field
      (3) pass instrumentation, equipment, and supplies to the surgeon and surgical assistant as needed
      (4) assess and predict (anticipate) the needs of the patient and surgeon and provide the necessary items in order of need
      (5) prepare and handle medication

[1] Association of Surgical Technologists (2006), pp. 281–282.

(6) count necessary items
(7) care of specimens
(8) assist with other intraoperative tasks
(9) prepare and apply sterile dressings

c. Postoperative
(1) assist surgical team with patient care, when needed
(2) prepare instruments for terminal sterilization
(3) assist other members of the team with terminal cleaning of the surgical suite
(4) assist in preparing the surgical suite for the next patient

2. Responsibilities of the surgical technologist in the circulating role

a. Preoperative
(1) obtain appropriate sterile and nonsterile items needed for the surgical procedures
(2) open sterile instruments, supplies, and equipment
(3) check patient's chart, identify patient, verify surgery to be performed with consent form
(4) transfer patient to operating room table
(5) provide comfort and safety measures
(6) provide verbal and tactile reassurance to the patient
(7) assist anesthesia personnel
(8) position the patient, using appropriate equipment and safety measures
(9) apply electrosurgical grounding pads, tourniquets, and monitors on the patient, using appropriate safety measures
(10) prepare preoperative skin
(11) performs counts

b. Intraoperative
(1) position and operate equipment needed for the procedure
(2) anticipate additional supplies needed during the procedure
(3) facilitate communication between sterile and nonsterile areas
(4) accurately record documentation throughout the procedure
(5) care for specimens
(6) secure dressings after incision closure

c. Postoperative
(1) help transport patient to recovery room
(2) assist in terminal cleaning of the surgical suite
(3) prepare for the next patient.

APPENDIX C

Data-Collection Tool: Air Force[1]

This data-collection tool was emailed to a point of contact in each service, who then forwarded it to surgical technologist supervisors in the grades of E-5 and above. The responses were emailed back to RAND.

For each of these questions, we are interested in your views derived from your own experience. Please answer the questions based on the current status within your career field. Where appropriate, questions ask for a minimum and maximum as well as an average. What we are trying to capture is a range that would be representative of most everyone in the career field as well as an approximate average. Throughout this survey, Year of Service (YOS) refers to the number of years since enlistment into the Armed Forces. AFSC is your AF specialty code.

RESPONDENT INFORMATION:

1. What is your grade? ____________ , and AFSC? _____________
2. Have you ever served as an instructor? ______________________
3. How many years have you served in the military? ____________

A FULLY MISSION-EFFECTIVE WORKER:

4. In many career fields, the goal of technical training is to produce a “mission-ready” airman. In addition to these skills, a fully mission-effective worker is the person:

[1] The data-collection tool was tailored to each service so the nomenclature used was specific to the service.

- that you would probably want to send on a short notice TDY to "base X" to resolve a nebulous, yet difficult problem with little to no supervision
- that you can count on to effectively handle most AFSC-related situations that arise
- who knows how to operate effectively in a normal, exercise, or deployed environment
- who can train junior members effectively and properly document it
- who knows how different organizations in the unit work, those organizations' responsibilities, and how those organizations interact with one another to meet mission requirements
- who can organize and/or direct others to complete work
- who is called your "go-to person"

At what point in time (grade and YOS) do you believe a person in your career field is a "fully mission-effective" worker? Do not include leader/manager skills (E6 and above) as you consider a fully mission-effective worker.

	Average	Minimum	Maximum
Grade:	________	__________	_________
YOS:	________	__________	_________

5. Do you believe the description of being "fully mission-effective" is accurate? If not, what is lacking or overstated? How would you define "fully mission-effective"?

____

____

____

6. Given the minimum and maximum YOS you answered in question 4 to be a fully mission-effective worker, how effective is an Airman compared to this "fully mission-effective" or 100% person at the following milestones?

Average

a. End of YOS 1? ________________%
b. End of YOS 3? ________________%
c. End of YOS 4? ________________%
d. End of YOS 5? ________________%
e. End of YOS 7? ________________%

7. At what YOS does an individual finish their CDCs?

Average

a. 5-level CDCs? _______

8. In this AFSC, how effective is an individual at the following milestones?

Average

a. End Phase 1 (classroom)? ________%

(Answer 8a only if you have been a phase 2 instructor or you can remember your experience as a trainee)

b. End Phase 2 (clinical)? ________%
c. Their 5-level? ________%

OJT:

9. What would you estimate the percent of time, on average, an experienced person (a trainer with approximately 5–12 years of service) spends performing OJT:
   a. With a recent 3-level graduate? ________%
   b. With an average 5-level? ________%

10. What would you say is the typical rank and time in service of the individual conducting OJT? What do you think the rank and time in service ideally should be?
    a. Actual: GRADE: ___________; YOS:___________
    b. Ideal: GRADE: ___________; YOS:___________

DEPLOYMENT:

11. What is the required level of mission effectiveness needed before an airman should deploy? Remember that 100% refers to a fully mission-effective worker.

___________%

APPENDIX D

Role and Value of Accreditation

The Commission on Institutions of Higher Education of the New England Association of Schools and Colleges (n.d.) offers an overview of the role and value of accreditation.[1] This paper was prepared by the Council on Postsecondary Accreditation, which has been succeeded by the Council on Higher Education Accreditation.

> I
>
> Accreditation has two fundamental purposes: to assure the quality of the institution or program, and to assist in the improvement of the institution or program. Accreditation, which applies to institutions or programs, is to be distinguished from certification and licensure which apply to individuals.
>
> . . .
>
> Institutional or specialized accreditation cannot guarantee the quality of individual graduates or of individual courses within an institution or program, but can give reasonable assurance of the context and quality of the education offered.
>
> . . .

1 New England Association of Schools and Colleges (n.d.).

III

A specialized accrediting body focuses its attention on a particular program within an institution of higher education. The close relationship of the specialized accrediting body with the professional association for the field helps ensure that the requirements for accreditation are related to the current requirements for professional practice.

In a number of fields (e.g., medicine, law, dentistry) graduation from an accredited program in the field is a requirement for receiving a license to practice in the field. Thus specialized accreditation is recognized as providing a basic assurance of the scope and quality of professional or occupational preparation. This focus of specialized accreditation leads to accreditation requirements that are generally sharply directed to the nature of the program, including specific requirements for resources needed to provide a program satisfactory for professional preparation. Because of this limitation of focus to a single program, many specialized accrediting bodies require that the institution offering the program be institutionally accredited before consideration can be given to program accreditation.

Specialized accreditation encourages program improvement by application of specific accreditation requirements to measure characteristics of a program and by making judgments about the overall quality of the program. For a non-accredited program, the accreditation requirements serve as specific goals to be achieved. In addition to accrediting standards, assistance for program improvement is provided through the counsel of the accreditation visiting team members, which include practitioners of the profession and experienced and successful faculty members and administrators in other institutions.

. . .

V

In fulfilling its two purposes, quality assurance and institutional and program improvement, accreditation provides service of value to several constituencies:

To the public, the values of accreditation include:

a. An assurance of external evaluation of the institution or program, and a finding that there is conformity to general expectations in higher education or the professional field;

b. An identification of institutions and programs which have voluntarily undertaken explicit activities directed at improving the quality of the institution and its professional programs, and are carrying them out successfully;

c. An improvement in the professional services available to the public, as accredited programs modify their requirements to reflect changes in knowledge and practice generally accepted in the field;

d. A decreased need for intervention by public agencies in the operations of educational institutions, since their institutions through accreditation are providing privately for the maintenance and enhancement of educational quality.

To students, accreditation provides:

a. An assurance that the educational activities of an accredited institution or program have been found to be satisfactory, and therefore meet the needs of students;

b. Assistance in the transfer of credits between institutions, or in the admission of students to advanced degrees through the general acceptance of credits among accredited institutions when the performance of the student has been satisfactory and the credits to be transferred are appropriate to the receiving institution;

c. A prerequisite in many cases for entering a profession.

Institutions of higher education benefit from accreditation through:

a. The stimulus provided for self-evaluation and self-directed institutional and program improvement;

b. The strengthening of institutional and program self-evaluation by the review and counsel provided through the accrediting body;

c. The application of criteria of accrediting bodies, generally accepted throughout higher education, which help guard against external encroachments harmful to institutional or program quality by providing benchmarks independent of forces that might impinge on individual institutions;

d. The enhancing of the reputation of an accredited institution or program because of public regard for accreditation;

e. The use of accreditation as one means by which an institution can gain eligibility for the participation of itself and its students in certain programs of governmental aid to postsecondary education; accreditation is also usually relied upon by private foundations as a highly desirable indicator of institutional and program quality.

Accreditation serves the professions by:

a. Providing a means for the participation of practitioners in setting the requirements for preparation to enter the professions;

b. Contributing to the unity of the professions by bringing together practitioners, teachers and students in an activity directed at improving professional preparation and professional practice.[2]

2 See http://cihe.neasc.org/downloads/POLICIES/Pp63_Role_and_Value_of_Accreditation.pdf

APPENDIX E

Estimating Trade-Offs Between Training Time and Productivity: Review of Previous Studies

Our methodology builds on and extends previous work in this field.[1] Haggstrom, Chow, and Gay (1984) developed the Enlisted Utilization Survey, a large-scale survey of trainee supervisors that attempted to measure the productivity of enlistees over time. Survey respondents were asked to rate the net productivity of their own trainees relative to the typical individual with four years of experience in the same specialty at four distinct time points as well as to rate the net productivity of an "average trainee" at the same points. Horowitz and Angier (1985) used a regression model to measure the relationship between experience (measured by rank, years of service, prior sea experience, and quantity of training) and productivity (measured by the amount of mission-degrading downtime suffered by the maintained equipment) for individuals in six Navy maintenance career fields. They found a significant correlation between quantity of formal training and productivity in five of the six career fields and a significant relationship between rank and productivity across all six fields. Oliver et al. (2002) developed productivity curves for aircraft maintenance specialties by surveying a small number (20–30) of SMEs in each maintenance specialty. They defined a fully mission-effective person as 100 percent productive when the individual was considered a "go-to" person by the leadership (something we use in our survey as well). Oliver et al. used the productivity

[1] This section is largely excerpted from Manacapilli et al. (2007).

curves and an annualized cost of leaving (ACOL) model to evaluate various incentive programs.

Most of the studies that have attempted to examine the relative efficiency of "schoolhouse" or learning center training and OJT have looked at differences between regular and directed-duty enlistees (where the latter are selected enlistees who bypass schoolhouse training and receive all their upgrade training on the job). Weiher and Horowitz (1971) compared the relative costs of formal and on-the-job training for Navy enlisted occupations by asking respondents to estimate how long it took the average trainee to reach "third-class" level and how much time senior personnel spent on OJT instruction. This study also attempted to develop productivity profiles of "A" school (the Navy equivalent of schoolhouse training) graduates and directed-duty enlistees by having respondents draw a separate curve for each, showing the proficiency over time of a typical trainee relative to that of a person "professionally qualified to take the third-class exam." The authors used the survey data to generate estimates of school costs, value of forgone productivity, and supervisor costs for each of the training nodes. The results indicated that when all the relevant costs are considered, 37 out of 39 career fields are more efficiently trained at "A" school. The authors emphasize, however, the importance of accurate estimates of "supervisor costs" in generating the apparent efficiency.

Smith (1986) used observational data on first-term airmen to determine if there was a significant difference in productivity between technical school graduates and directed-duty airmen in each of their first four years of enlistment. Although there was little difference between the productivity of the two groups during years 2, 3, and 4, "first-year" technical training graduates spent a significantly greater proportion of time doing productive work. Smith used these proportions, estimates of lost trainer productivity from OJT (from SME interviews), and estimates of the cost of technical training (published Air Force data) to compare the total costs of each method and reported that directed-duty airmen cost more in total than did technical training graduates. Quester and Marcus (1986) used Navy data from an Enlisted Utilization Survey to compare the productivity of "A" school graduates versus directed-duty assignees in seven Navy specialties, where productivity

was defined as a "net productivity"—the contribution of the trainee minus the loss in production of the experienced personnel who must provide supervision. They found that the productivity of "A" school graduates relative to directed-duty assignees, over the course of their entire first-term enlistment, ranged from 1.16 to 1.41, and that the total cost per unit of effectiveness was lower for "A" school in four of the seven fields.

Fleming et al. (1987) calculated the costs of unproductive trainee time during OJT periods and the costs of unproductive trainer/supervisor time during those same periods. They estimated that the cost of the unproductive OJT time exceeded the published cost of technical training in 23 out of 37 specialties. Gay (1974) developed an OJT costing methodology based on an application of human capital development (HCD) theory. The military's investment in OJT was measured as the "present value of the sum of positive differences between an individual's military pay and productivity over time"; pay was measured as the expected value of military pay and allowances in the particular military specialty by length of service; productivity was measured by supervisors' estimates of the time required for individual trainees to reach readily identifiable milestones in their OJT performance. He concluded that OJT costs form a substantial portion of training costs.

Manacapilli et al. (2007) used a deterministic, steady state model to compare the costs and mission-effectiveness benefits of various combinations of schoolhouse training and OJT. They used a short survey instrument to elicit opinions from SMEs about the manner in which the learning center prepares airmen and how OJT increases productivity over time. By statistically averaging the responses, they created productivity curves and then were able decompose force costs into two parts: costs associated with productive effort and HCD costs. Their analysis demonstrated that not accounting for the full costs of OJT significantly downplays true training costs. One of their significant findings was that a small addition of schoolhouse training time could result in a significant increase in productivity.

For purposes of this analysis, we address only service members in the active duty component. The productivity of service members at different points in the career underpins our cost analysis—without

this crucial piece of information, we are unable to estimate the effect of different training regimes on the costs of producing a fully productive member. Unfortunately, it is difficult to estimate the productivity of reservists over their career or the percentage of time they actually spend on surgical technologist duties as opposed to more general military work during their two-week annual training and their monthly drills.

APPENDIX F

Using a Nonlinear Function to Estimate Effectiveness Curves

When fitting curves to observations based on percentages that are not normally distributed and contain a substantial number of observations at 0 percent or 100 percent, it is common practice to use a normalizing transformation of the data. To reduce the variability and better fit a curve to the data, we used an arcsine-square root function for this transformation. After this step, we employed a nonlinear regression tool to fit a learning curve. To bring the relationship back to the original effectiveness scale, a reverse transformation was necessary.

We fit the data to the learning curve model below[1]:

$$Productivity = alpha - beta * EXP(- gamma * YOS)$$

where *alpha, beta,* and *gamma* are estimated using nonlinear regression techniques. Alpha estimates the upper horizontal asymptote. (Alpha – beta) estimates the *y*-intercept (amount still to learn at time 0). Gamma determines the shape of the curve. Tables F.1 and F.2 show the parameter values of the nonlinear fit for the Air Force and Navy data, respectively.

Figures F.1 and F.2 are the result of fitting a curve to the predicted Air Force and Navy data for the specialty. Also in the figures are the

1 Haggstrom, Chow, and Gay (1984).

Table F.1
Parameter Values, AFSC 4N1X1: Air Force

Parameter	Estimate	Approximate Standard Error	Lower Confidence Limit	Upper Confidence Limit
Alpha	1.56	0.039	1.49	1.65
Beta	1.30	0.050	1.20	1.40
Gamma	0.563	0.078	0.427	0.733

Measures of fit

Sum of squared error	Degrees of freedom	Mean squared error	Standard deviation of the residual error
6.645	158	0.042	0.205

NOTE: Measures of fit are based on the transformed data.

Table F.2
Parameter Values, NEC HM8483: Navy

Parameter	Estimate	Approximate Standard Error	Lower Confidence Limit	Upper Confidence Limit
Alpha	1.61	0.075	1.49	1.82
Beta	1.56	0.078	1.41	1.73
Gamma	0.539	0.098	0.356	0.765

Measures of fit

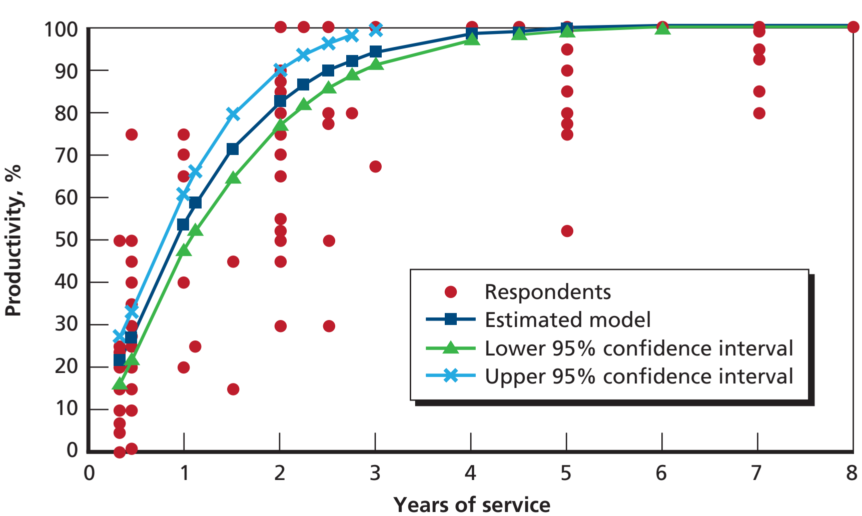
Sum of squared error	Degrees of freedom	Mean squared error	Standard deviation of the residual error
7.992	156	0.051	0.226

NOTE: Measures of fit are based on the transformed data.

upper and lower lines of a 95 percent confidence interval about the predicted means.[2]

The mean response regarding the time required for 100 percent effectiveness is about 4.3 years. However, when asked about the level of effectiveness at points of time later than that, the mean response was less than 100 percent. This was evident in our earlier work and we believe that it reflects respondents' willingness to attach a number of years of experience to 100 percent productivity but unwillingness to attach 100 percent effectiveness to any specific years of experience because respondents believe that there is always something more that airmen could learn to increase their effectiveness, largely in the area of leadership or management. Because these are not relevant to our analysis, we scaled the productivity curve in Figures F.1 and F.2 to account for the fact that respondents felt that a person was fully

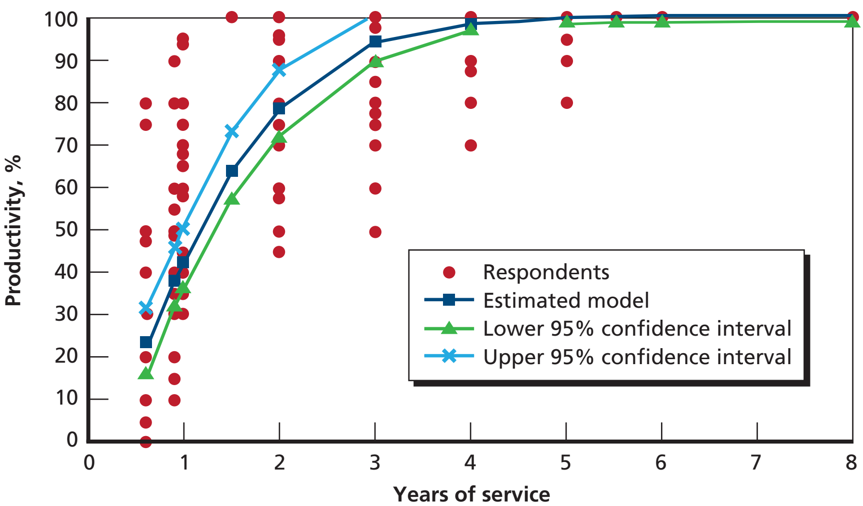
Figure F.1
Fit of Productivity Data, AFSC 4N1X1: Air Force



RAND *MG774-F.1*

2 If we fit a similar model to another group of 30 individuals, the 95 percent confidence intervals represent the region where a new line will fall 95 out of 100 times.

Figure F.2
Fit of Productivity Data, NEC HM 8483: Navy



RAND *MG774-F.2*

mission-effective by 4.3 years. The amount of scaling was less than 1 percent; the factor we used was 1.0088, or approximately 0.88 percent.

APPENDIX G

Summary of Prior Studies on Buy Options

Lateral Entry of Trained Civilians

Several studies have examined the feasibility of hiring trained civilians into a military specialty.[1] This appendix summarizes findings from this earlier work.

Recruiting community college graduates or graduates of civilian institutions has been considered and used several times over the past decades. In looking at the Navy's efforts to recruit community college graduates, Golfin (1998) pointed out a number of reasons for doing so, including low first-term attrition; a graduation cycle that takes some peak-load pressures off boot camp; the tendency of community college graduates to score higher on the Armed Services Vocational Aptitude Battery, which allows them to qualify more often for "critical ratings"; and the possibility that community college graduates will possess skills that may lead to savings in Navy training costs.

In 1996 and 1997, for example, the Navy focused on recruiting pretrained community college graduates in a variety of allied health careers such as radiography, clinical lab technician, surgical technologist, pharmacy technician, and dental hygienist. These efforts included loan repayment for graduates entering critical ratings, incentives for recruiters, agreements between Navy recruiting and community colleges, and other tactics. However, the efforts were not overwhelmingly

[1] See, for example, Kleinman and Hansen (2005); Asch, Du, and Schonlau (2004); Levy, Moini, Sharp, and Thie (2004); Kilburn and Asch (2003); Golfin (2006); Levy, Christensen, and Asamoah (2006); Golfin (1998); Golfin and Curtin (1998).

successful, and Golfin offered a number of reasons for this. Recruiters may be uncomfortable in the college environment and may feel that their efforts will not be successful. Unemployment rates were low during the 1996–1997 time frame, further hampering recruiting. Golfin suggested that there may be ways to increase the effectiveness of community college recruiting, including expanding loan repayment, formalizing cooperation and communication between recruiters and community college administrators via articulation agreements, encouraging recruiters to take classes at community colleges in uniform and requiring them to attend community college job fairs, taking advantage of the Military Recruiter Access to Campus Law by requesting name lists, and other methods. Golfin also detailed a partnership between Navy recruiters in Jacksonville and the Florida Community College at Jacksonville (FCCJ), where FCCJ would offer "Navy-tailored degrees in naval engineering technologies that could reduce or eliminate training for graduates enlisting in the nuclear field . . ." (p. 28). This arrangement can be advantageous for the community college, which is able to offer an attractive program, and to the Navy, which is able to save on training costs.

Work done at RAND also considered the lateral entry of non-prior-service personnel into enlisted, active duty occupations.[2] Non-combat-related occupations with clear civilian counterparts and various training programs appear to be good candidates for lateral entry. The surgical technologist occupation certainly fits into this category, given the similarity in work between civilian and military surgical technologists, along with the multitude of training options and programs available. Currently, the Air Force does not permit lateral entry from civilian occupations. The Navy and Army do offer lateral entry opportunities, but fewer than 1 percent of regular enlistments in the Army and Navy occur via the Army Civilian Acquired Skills Program (ASCAP) and the Navy's Direct Procurement Enlistment Program (DPEP). Although the military does not use lateral entry extensively, many public and private sector organizations do.

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[2] Levy et al. (2004).

According to the authors, "lateral entry programs can be aimed at achieving at least four goals:

- reducing training costs,
- filling gaps in personnel profiles,
- expanding recruiting markets, and
- avoiding the disruption of general military culture.

Once the priority of goals for a given program is identified, program features should be selected to support them. Four categories of program features can be manipulated:

- occupations into which lateral entry will be permitted,
- training and experience levels required of lateral entrants,
- scale and flexibility of implementation, and
- incentive structure" (p. xiii).

If the reduction of training costs is a goal of a lateral entry program, the military should focus on occupations with high military training costs relative to both other military occupations and to the counterpart civilian occupations. Related to cost, some lower-cost occupations may be reasonable candidates for lateral entry, particularly if large numbers of personnel need to be trained. Lateral entrants will complete basic training on entry, and the military will award rank on the basis of experience and training. The authors caution that although it may be efficient to place lateral entrants into high-rank leadership positions, this may be disruptive to military culture. The authors cite the excess capacity of the U.S. military training infrastructure, which dictates that lateral entry would need to be implemented widely to justify the reduction of the training infrastructure to achieve cost savings. The military needs to carefully consider incentive structures to attract civilian candidates, balancing enticement goals against the possible negative morale effects for military personnel not receiving these incentives.

The authors lay out program characteristics for a lateral entry system designed to reduce training cost. According to their analysis, a suitable lateral entry program should have the following:

- occupations with high military training costs
- entrants with advanced training
- enough external labor supply to consistently support a large number of lateral entrants
- occupations whose civilian members earn the equivalent or less than their military counterparts (pp. xv–xvi).

Not surprisingly, the authors find that occupations with high training costs are the best candidates for lateral entry. Recruiting entrants with advanced training allows for further cost savings but necessitates the consideration of possible resentment from service members who have trained solely within the military training infrastructure. The authors therefore suggest that recruiting all or almost all members of an occupation through a lateral entry program may help to mitigate such resentment. Finally, focusing on occupations with low civilian earnings relative to military earnings will allow the military to use the pay difference as a "built-in" incentive, rather than creating the need for large incentive programs.

In their report looking at military compensation and whether the compensation structure adequately supports the All-Volunteer Force, Kleinman and Hansen (2005) address ways in which compensation can be better targeted to personnel and potential personnel. They posit that training is a type of compensation valued by potential recruits and actual enlistees; thus, service in the military is more attractive to certain individuals than to others. This training has high value to recruits and high cost to the military. The authors claim that "there is nothing about the military mission, however, that requires enlisting untrained recruits who possess the motivation to be trained. Rather, the structure of the compensation system causes this form of selection. The Services could recruit from the pool of pretrained people instead, but the compensation system is not targeted to these people" (p. 14).

To recruit from the pool of pretrained people, the authors suggest that the portion of the compensation package related to training needs be made attractive to this group: student loan repayment and agreements with colleges to award credit to students for military training, coursework, and occupational specialty.

However, one drawback noted by Golfin and Curtin (1998) is that the “flow of pretrained recruits can be very unpredictable, and it is difficult to assess the competencies of people graduating from different institutions with very different curricula” (p. 6).

Outsourcing Training

As with the previous buy option, a number of studies have examined outsourcing of military training.[3]

Several reasons have been put forward for using civilian organizations (primarily community colleges) as providers of technical training for the military (active and reserve):

- reduced costs over military-provided training
- source of additional recruits, because civilian-provided training may facilitate later entry into a civilian job and so may attract more recruits
- refresher training for the reserve components
- retraining to improve reserve component readiness
- increased ratio of operational to nonoperational units in the military components (because military personnel will be relieved of the responsibility of provided technical training, nonoperational training units can be reduced in size or eliminated).

Concerns regarding civilian-provided training include:

- quality control over the curriculum and ways to evaluate the training provided
- uniqueness of military equipment and missions
- elimination of “soldierization”—the inculcation of military culture and bearing

[3] Levy, Christensen, and Asamoah (2006); Rattelman, Marr, and Sanders (2002); Golfin, White, and Curtin (1998); Tighe, Jondrow, Kleinman, Koopman, and Moore (1996); Hanser, Davidson, Stasz, and Martin (1991).

- possible erosion of current military training system with implications for the ability to train and deploy soldiers in times of emergency or mobilization.

Hanser et al. (1991) warn that the selection of a particular training program design over competing alternatives "should be based not just on the initial costs of producing a given number of occupationally qualified recruits; it should also take into account how long the military has access to the skills and how much it costs to maintain them" (p. 26). They suggest using a single measure of trained man-years (TMY)—which is based on the expected number of enlistments and the expected life cycle over which that cohort is occupationally qualified. "The best use of training dollars would then entail selecting the option that minimizes the present discounted value of the stream of costs for each option that produces a given level of TMY over the relevant time horizon" (p. 26).

Categories of costs entailed in producing an initial skill qualified recruit (categories will apply regardless of who trains; the amounts may vary with the provider) include:

- training-related costs: variable costs (student-related costs and instructional delivery costs); short-run fixed costs (overhead, curriculum development, facilities, and equipment)
- screening costs: recruiting and placement; selection of trainers
- monitoring costs: performance evaluation of students; performance evaluation of trainers.

Table G.1 presents some likely effects of program characteristics on trained man-years and on costs.

Hanser et al. (1991) list the variables that need to be considered when making a decision regarding civilian-provided training:

- Similarity of military and civilian occupations: If the two occupations are similar, the greater the flexibility of choice among training alternatives. However, it is not necessary for military and civilian occupations to be identical—there is always an element of

Table G.1
Summary of Potential Effects of Training Program Characteristics on Trained Man-Years and the Costs of Producing Them

Program Characteristic	Implicatons for Trained Man-Years	Costs of Producing Trained Recruits	Cost of Recruiting and Retaining Recruits
Civilian curriculum content and delivery	Increased enlistment by enhancing training value postservice; decreased retention by raising costs of staying relative to civilian employment	Lower instructional and curriculum development costs; higher costs from screening and monitoring	Lower recruiting costs; higher compensation costs to promote retention
Local training	Increased enlistment and retention (especially for reserves) by reducing costs of military service; for actives, some enlistment decrease because of higher costs of leaving community where contacts established	Lower station change and student compensation costs; higher costs for extensive screening and monitoring	Lower recruiting and in-service compensation costs, especially for reserves; for actives, partially offset by somewhat higher recruiting costs
Preenlistment training	Decreased retention by raising costs of staying as training cost is sunk; increased length of service following training	Lower student compensation costs; higher refresher training costs and recruit screening costs	Higher in-service compensation costs to promote retention
Recruit self-sponsorship (who pays for the training)	Decreased enlistment and retention by reducing net returns to military service; decreased enlistment by raising cost barrier to joining	Lower instructional delivery and student compensation costs	Higher recruiting and in-service compensation costs

SOURCE: Hanser et al. (1991).

OJT that is specific both to the organization and to the work site itself; military personnel tend to receive substantial supervision during performance of all but the simplest tasks.

- Specificity of military equipment within the occupation: The extent to which military personnel use highly specialized equipment not readily available or used by civilian personnel in that specialty. This may not be as much an issue for enlisted medical personnel.

- Geographic availability of occupational training: The extent to which the particular training is widely offered by civilian institutions. The study points out that this would be most feasible for reservists.
- Existence of established quality assurance mechanisms: Existence of federal or state licensing, accreditation by recognized agencies, etc., will reduce costs of monitoring quality and assuring the proficiency of the graduate.

Other studies point out that partnerships between the Navy and community colleges could help the Navy train and recruit. The Navy could develop programs with community colleges that allow for total overlap with Navy training. Partnerships could also be created that would allow a recruit to earn an associate degree while on active duty, a useful recruiting tool. This might also benefit recruiting more generally on community college campuses.

One Navy program recruits pretrained people with associate degrees in certain allied health areas for the HM rating. Very few people have been recruited using this program, and a more formal partnership with community colleges offering allied health curricula could increase the recruiting of these individuals. The authors believe that this more formal partnership would be beneficial to both the Navy and to the community colleges, because cost savings opportunities are great, there is civilian overlap, and many community college allied health programs require an externship. These opportunities could be provided at Navy facilities, assisting the community colleges and increasing propensity to enlist.

Golfin, White, and Curtin (1998) find that, for a variety of reasons, community colleges are able to provide training similar to Navy training at a lower cost. Courses with small throughput at great Navy expense are good candidates for community college training, because the community college is able to spread the fixed costs of training over all students, reducing average training cost. State governments subsidize community college tuition costs, and community colleges often have partnerships with industry that can further reduce training costs. Community colleges do not have to pay to train instructors, who tend

to be more experienced than their military counterparts; turnover is low at these institutions; and enrollment competition gives community colleges incentives to be efficient and to keep up with changing technology.

The use of community colleges for enlisted training may have recruitment benefits as well. Students at community colleges may become more aware of the Navy with increased Navy presence on community college campuses, and students may be able to gain more college credits via community college courses than they can acquire for an equivalent Navy course. Service members may be eager to gain these credits while on active duty. The authors do caution that there are concerns to the community college model though. Instructor tours are perceived as desirable shore tours, and the authors find evidence that these tours have a positive effect on retention and may increase sailor productivity when they return to the fleet. Service members taking civilian courses will possibly not gain military acculturation, whereas military instructors are able to provide recent fleet experience and aid in acculturation.

The authors found that community colleges were "willing and eager to modify current programs to accommodate the Navy's training requirements, including, if necessary, Navy instructors" (p. 3). Significant training cost savings can be realized by outsourcing training to community colleges, but the total savings are more complicated to compute. The authors suggest that courses with a good deal of overlap with civilian courses in equipment and subject are good candidates for outsourcing. They also note that although the Navy supported outsourcing two "C" school courses, it did not support outsourcing "A" school instruction, because of concerns about acculturation and militarization.

Rattelman, Marr, Sanders (2002) evaluated a pilot study training program where the Navy contracted out a portion of their Medical Laboratory Technician program beginning in January 1999. Navy students on the West Coast continued to attend a Navy MLT course at NSHS San Diego, and east coast students were sent to Thomas Nelson Community College in Hampton, Virginia. NSHS Portsmouth was responsible for providing oversight to Thomas Nelson Community

College's program. TNCC was allowed to develop and own a unique academic curriculum for the Navy, meeting certain requirements including accreditation, and within certain parameters established by the Navy (maximum number of training days, capacity requirements, time for Navy-specific training, use of NMC Portsmouth for clinical lab portions of course, etc.). It is important to note that TNCC was not required to duplicate the Navy's in-house program. The program varied somewhat from the Navy's program, although the curricula were largely similar. Major differences were that TNCC provided six months of didactic instruction followed by six months of clinical lab, whereas NSHS San Diego alternated quarters of didactic and lab modules. TNCC also had greater flexibility to modify and adapt the program than NSHS San Diego had.

The authors measured the success of the program across six measures of success: quality of product, production success, cost efficiency, student satisfaction, end-user satisfaction, and military bearing.

TNCC graduates had a significantly higher pass rate on the certification examination offered by the American Society for Clinical Pathology (ASCP), even after controlling for differences between graduates of the NSHS course and the TNCC course. It is important to note that although exam preparation and review are included in the TNCC course, the Navy does not emphasize passing this exam as a specific requirement or objective.

The authors calculated two measures of attrition in an attempt to control for a difference between the two programs' handling of struggling students. Using one measure, there was no statistically significant difference in academic attrition; using another measure and predicting attrition based on sending a pooled population to each of the two programs, NSHS San Diego was estimated to have a 29 percent academic attrition rate compared with 10 percent for TNCC.

The authors calculated cost efficiency by looking at the per graduate cost of TNCC and NSHS San Diego, excluding student salaries. Cost was measured per graduate to account for attrition costs. Including NSHS overhead in the TNCC program, the per graduate cost for TNCC was 6 percent lower than the cost for NSHS San Diego.

Excluding NSHS overhead, over which TNCC had no control, the advantage rose to 15 percent.

With regard to student satisfaction with the program, controlling for student quality and demographics, TNCC attendance was associated with higher rates of satisfaction on about half of the measures included in the survey, including questions regarding instructional quality. With respect to the remaining measures, there were no statistically significant differences in satisfaction levels between the programs. Students were again surveyed four months after graduation with regard to how well the program prepared students and their ability to apply knowledge at their first duty station. There were no statistically significant differences at the four month point.

With regard to quality of life, the authors measured the TNCC program against other programs at NSHS Portsmouth and results were mixed. With regard to end-user satisfaction, there were no statistically significant differences in supervisor satisfaction after controlling for student differences.

With regard to military bearing, or the militarization of students attending the two programs, controlling for student differences, there were no statistically significant differences in incidence of disciplinary actions. At four months after graduation, there were no statistically significant differences in supervisor satisfaction in military bearing and attitude, but interim 12-month findings indicate that TNCC is "associated with lower rates of supervisor satisfaction with regard to the graduate's attitude toward the job." With regard to graduates' ease of adjustment to standards expected at command, there were no statistically significant differences between TNCC and NSHS San Diego graduates.

At least with respect to this program, the study suggests that, given equal-length programs, outsourcing training appears to be a viable and cost-effective option for training medical laboratory technicians.

APPENDIX H

Military-Civilian Conversions

Although this option has become moot because of the moratorium, we provide some insights from prior research that are useful to keep in mind when considering military-to-civilian conversions.[1] This research largely focuses on the cost methodology used to justify conversion of military billets.

In a broad discussion of outsourcing as it pertains to the Navy, Tighe et al. (1996) consider which occupations and activities might be good candidates for outsourcing, finding that "a first cut at identifying whether outsourcing makes sense is to define whether the candidate would be provided by the commercial sector" (p. 15). The authors note that health services functions in the military are found in the private sector, so competition is feasible. The authors identify individual occupations/activities that are outsourcing candidates—occupations where these personnel are infrequently at sea and with "no compelling reasons that they be considered essentially military" (p. 31). Health services ratings, including HM (hospital corpsman) and DT (dental technician) represent a large percentage of the shore-intensive occupations and "hold large numbers of billets not required for rotation" (p. 33). Additionally, many of the activities performed by health services personnel in the Navy can be performed by individuals in the commercial sector. There is some concern that there may be a loss in militarization, especially regarding "A" school training.

1 Tighe et al. (1996); Gates and Robbert (1998); and Dahlman (2007).

It is widely assumed that civilians are "cheaper" than military service members, but this may not be the case in all situations. Gates and Robbert (1998) use two cost-comparison methods to examine this issue. The first is the traditional DoD approach, which compares military and civil service personnel cost at what are referred to as "comparable" grade levels in DoD Instruction 1000.1. For example, an O-6 is assumed to be equivalent to a GS-15, an O-5 is assumed to be equivalent to a GS-13 or GS-14, and so forth. Although this cost-comparison method allows the authors to conclude that civil service employees are less costly than military personnel, there is some question as to the validity of the underlying assumptions to this approach. The authors question the validity of the grade equivalencies used in this approach; most significantly, they question whether these administrative grade equivalencies "reflect comparability of work done by individuals in these grades" (p. xvi).

Another flaw in the traditional DoD method is that military-grade structures are in actuality quite rigid and centrally controlled and are unlikely to be altered by civilianization. The authors cite an example of the civilianization of 10 E-4 positions, and note that force-structure reductions will actually be spread over all enlisted grades, and not simply concentrated in E-4 (pp. 9–10).

A more effective comparison would perhaps compare equivalent work performed rather than comparable grade level and would also take into account the rigidity of the military-grade structure. There are three fundamental assumptions to this comparison method: First, the substitution is one-for-one, where one civil service worker replaces one military worker. Second, the civil service grade structure is altered by civilianization, as the proportion of people at different grade levels within the civil service will change. Third, and perhaps most significant, the military grade structure does not change (p. 10). Using this approach, the authors find that civil servants are sometimes less costly than military personnel but not always. They contend that there are "break-even" civil service grades, beneath which civilianization can save cost and above which it cannot. The authors caution against using cost alone to determine positions for civilianization, since this may limit civil service career progression possibilities and may cause

military-inventory shortfalls relative to requirements in higher grades (p. 56). Selecting multiple positions for civilianization at grade levels representative of the current grade structure will help mitigate the aforementioned problems with civilianization, but will likely sacrifice some savings to do so. Overall, using the alternative cost-comparison method developed by the authors, "cost-effective civilianization would require DoD to limit substitution to positions that could be filled with lower-grade civil service workers" (p. 63).

Dahlman (2007) notes that although civilianization has been suggested consistently by various secretaries of defense, mainly to save costs, the services have been largely resistant to these efforts. According to Dahlman, even if cost savings are possible:

> the tools for effecting a civilianization policy may simply not exist at the present time. In a system where retirement benefits drive personnel systems, which in turn drive authorizations, it is simply not possible to formulate policies that apply at the authorization stage . . . in other words, compensation would need to change to control retention, with civilianization pursued as a follow-on policy (p. 80).

Dahlman also illustrates an example that calls into question the savings that can be achieved by civilianization. If equipment maintenance positions at a depot were civilianized, a service may reassign personnel scheduled to have a tour at the depot. As a result of the benefits vesting system that allows service members to be vested after only 20 years of service, the service "would do everything possible to find [E-7 reassigned personnel] another assignment so that they would not lose vesting at YOS 20." If personnel are reassigned within their service, there will be no cost savings. The largest cost savings will occur if personnel go on to work in the private sector, and smaller cost savings will occur if personnel become civil servants, as they will be able to apply their military years of service to the federal retirement system (pp. 81–82):

> [I]n the end, the cost of a military billet should play a very small role in any decision to civilianize a military position; these deci-

> sions should take place within the larger context of a broad human resources strategy. The issues are what the proper experience mix of the force is and what the cost of seniority ought to be (p. xv).

Two Government Accountability Office reports also take issue with the way the services account for the effect of conversions on total costs. The May 2006 GAO report noted that the military departments did not foresee any effects of these conversions on medical readiness, quality of care, recruitment, and retention of military personnel, or access to care.[2] However, the cost issue was more difficult to assess, because the methodology being used by the services in their certification of these positions did not include the full cost of military personnel. At that time, the Program Analysis & Evaluation (PA&E) office was developing a cost methodology to account for direct and indirect costs for military personnel, including training and recruiting costs. The National Defense Authorization Act (NDAA) for FY2007 outlined detailed requirements for the departments to certify and report on planned conversions of military medical and dental to civilian positions. For example, the act required that each certification be accompanied by a written report that addressed, among other things:

- the methodology used by the Secretary in making the determinations necessary for the certification;
- the number of positions, by grade or band and specialty, planned for conversion;
- an analysis showing the extent to which access to care and cost of care will be affected;
- a comparison of the full costs for the military medical and dental positions planned for conversion with the estimated full costs for the civilian medical and dental positions that will replace them, including expenses such as recruiting, salary, benefits, training, and any other costs the department identifies; and
- an assessment showing that the military medical or dental positions planned for conversion are in excess of those needed to meet medical and dental readiness requirements (GAO, 2008, p. 3).

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2 U.S. Government Accountability Office (2008).

The 2008 GAO report noted that although each of the military departments had submitted certification packages that met most of the reporting requirements, none of them had provided an analysis of the impact of the conversions on the cost of care.

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